FLYING AND POPULAR AVIATION

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STOP JAPAN NOW!

by James R. [illegible]

NETHERLANDS INDIES ARE READY *by Maj. Gen. L. H. Van Oyen*

OUR WARPLANES ARE BEST *by Brig. Gen. George C. Kenney*

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YOU have heard politicians recently assail this country's national defense effort for being a "trickle when it should be a flood." Many of their statements are aimed at the aviation industry, which is as unfair as it is infuriating. Five years ago those same politicians looked upon our aviation industry as the silly whim of a bunch of eccentric lunatics; today they want an air force a day or a reasonable facsimile thereof.

The demands being made upon our aviation industry today are fantastic. Yet it has accepted the job with hardly a whimper and is doing the impossible so well it leaves the most blase of us a bit breathless. Two thousand complete military aircraft per month! Why, it was only a short time ago we thought 2,000 big planes per year comprised a lusty industry. And the modern warplane—far more intricate and complicated than the run-of-the-mine commercial ship—*still* is being put together by hand.

Many people still are unable to understand why aircraft cannot be put together on high-speed assembly lines in exactly the same manner as are automobiles. There is just the one answer: they are hand made. With some refinements, they still are building aircraft on the comparatively slow scale required by fine, precision craftsmanship. You have seen the rate of speed at which an automobile assembly line moves; there is nothing like that yet in aviation.

There are other delays, too—delays that could be eliminated by the very critics who lay the blame on the aviation industry: strikes, shortages of materials, numerous bottlenecks. Yet, despite all this, our factories are turning out airplanes faster than pilots can fly them away. So think of all this the next time you read one of those statments-to-the-press. Take our word for it, there are dozens of men in the aviation industry who are working themselves into early graves to give us the aeronautical superiority we have today.

* * *

THERE'S another one of those mad dashes around the countryside in our diary this month. Spent two days trying to get a seat on an airline to New York. Then one Saturday night, just as we were thinking of going to bed, a phone call advised that there was just one seat available on the plane leaving in two hours. So we went to bed in New York City instead. Then down to Washington for a day, followed by a quick ride up to Baltimore. Out at the Martin factory we climbed 24 steps to get to the level of

(*Continued on page* 104)

FLYING
AND POPULAR AVIATION
Trade Mark Registered

Volume XXIX Number 6

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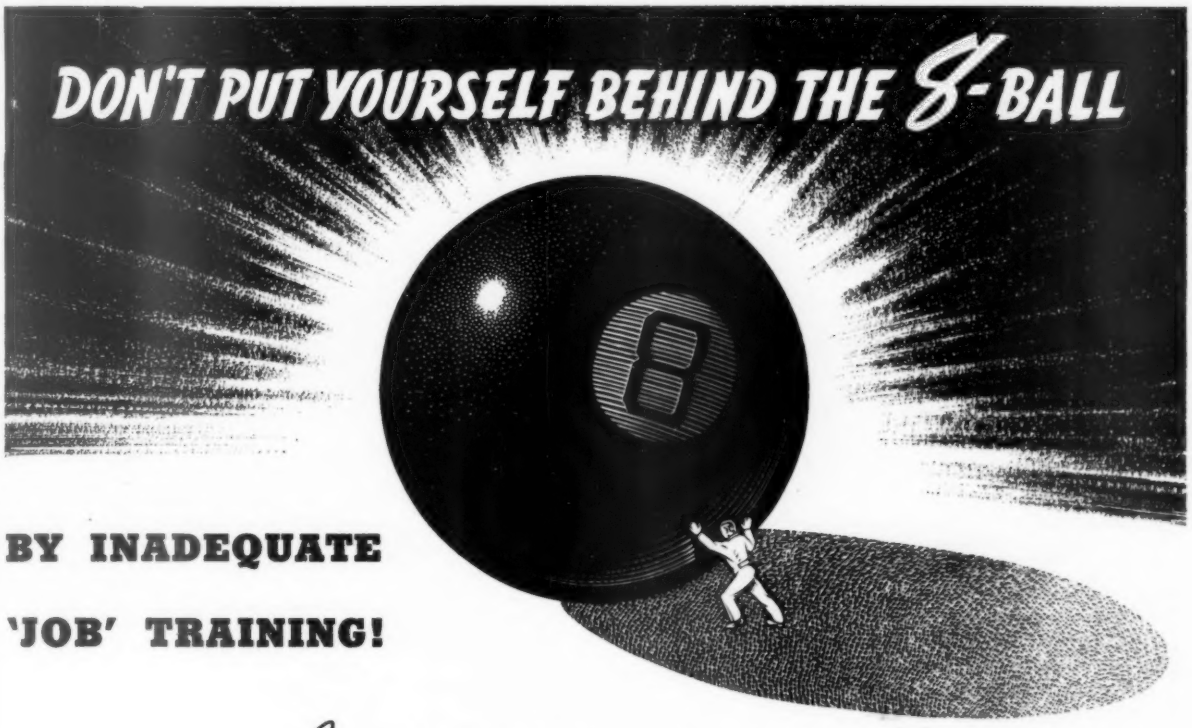
DON'T PUT YOURSELF BEHIND THE 8-BALL



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It is imperative that before you invest in a course of career training you determine what the returns will be on your investment . . . for your choice of a school in which to take your training will determine how much money you will make all the rest of your life.

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This school has never guaranteed positions for its graduates, but practically every graduate has obtained immediate employment and is advancing rapidly. The demand for our graduates far exceeds the supply, and we honestly believe that every student who enrolls here will be able to obtain, with our assistance, immediate employment upon graduation.

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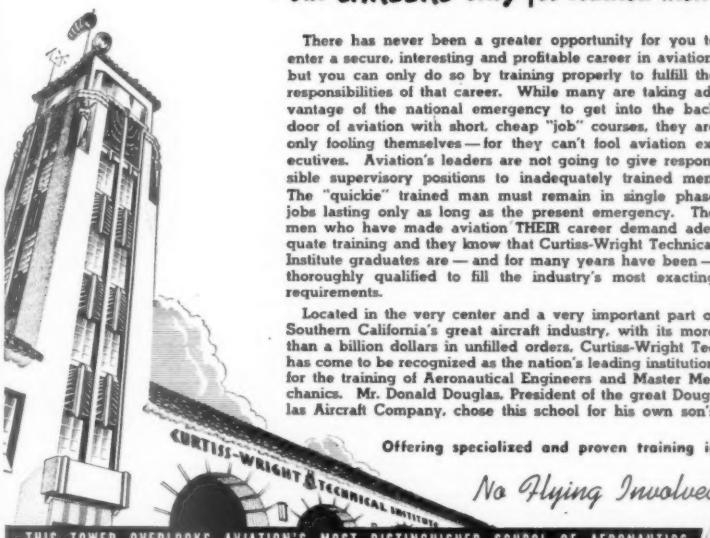

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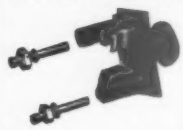

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Letters

Separate Air Force

Sirs:

. . . I have already read the November FLYING AND POPULAR AVIATION which contains your very splendid material for and against an independent air force. You are to be highly commended on this. It is my belief that your magazine grows in value monthly in such thought-provoking material that arouses intense interest and is most informative.

I have been vitally concerned in the separate air force idea for many years. I am a strong believer in this being accomplished. On the night of March 14, of this year, I spoke on the subject "A Separate Air Force Now" over the Columbia network, Sunday, June 29, I joined with Representative Osmers of New Jersey in a debate with Representatives Maas and Gale on the American Forum of the Air. I have appeared before the House Rules Committee in an effort to have this subject brought before the House, and have repeatedly tried to secure hearings before the Committee on Expenditures in the Executive Departments, where I have two bills pending, H.R. 3795 and H.R. 4532, which would bring about a unified air force or a separate department of air . . .

JENNINGS RANDOLPH,
Congressman from W. Virginia.
Washington, D. C.

Sirs:

. . . I have read the opinions with reference to separate air service. I wonder if this is a question which should be decided by Congressmen, or whether it should be decided by those whose training has fitted them to make this decision . . . I hope this is a matter that can be unanimously settled by the heads of our Army, Navy and Air Corps, and that all jealousies will be left out of the picture, and that they, as experts, will agree. I am not one, with my limited knowledge—and I believe many other Congressmen are in the same position—to override the opinions of such experts as these, and if they will bring in an opinion, I will back the heads of the Departments in their requests . . .

LELAND M. FORD,
Congressman from California.
Washington, D. C.

Son's Club

Sirs:

. . . My late husband, Dr. John F. Freund was holder of pilot certificate No. 4 given him by the International Federation (Francaise). He flew in 1911 . . . Today, my son, a recent college graduate, is training to be a pilot at the U. S. Army Air Forces' school, San Angelo, Texas. I'm certain there are many sons of veteran flyers who are following their fathers' aviation careers . . . Don't you think they should be brought together to form some sort of a club?

DR. MATHILDE FREUND.
Scarsdale, N. Y.

● What do other readers think?—Ed.

Radian Definition

Sirs:

In the July issue Mr. Hoyt, in the article "How Fast the Turn", says that the circumference divided by the radius yields the rate of turn, called radian. . . . The definition of a radian as taught in Manitoba schools is: "the angle subtended at the center of a circle by an arc equal in length to the radius." Why does Mr. Hoyt confuse a measure of an angle with rate which involves time?

VERNON L. DUTTON
Winnipeg, Manitoba, Can.

Forced Landings

Sirs:

. . . With reference to the article "We Pilots Want Service" [October issue], I note you comment that you do not necessarily agree with Mr. Churchill's views. . . . I agree with them entirely and if you do not also agree . . . it is probably due to the fact that you have not had as much experience in getting around over the country in a lightplane as he has . . .

Mr. Hoyt's article, "Are You Forced Landing Conscious"—in the same issue—leaves me entirely cold and unresponsive. I have read volumes of this advice and have seen the three *don't stall* rules on bulletin boards from Mexico to the Great Lakes, but still they stall. You can't fly on good advice. If some of the precious hours that are devoted to forced landings was devoted to stall instruction at safe altitudes, there would be fewer accidents.

It would be interesting to know how many actual forced landings were made in 1940 . . . I dare say there was nothing like 41 actual forced landings and that very few of these resulted in accidents. . . . The prevention we are using is already more deadly than the disease we are trying to prevent.

. . . My flying experience may have all been unusually fortunate but it has been spread over a very large area and in the last three years in several states I have run across two actual forced landing cases and both pilots made safe landings. Both were students without much experience in simulated landings.

SMITH H. LAPSLEY
Tulsa, Okla.

Gliding Speed:

Sirs:

. . . Mr. Hoyt's article, "Are You Forced Landing Conscious?" [October issue] . . . is the first that I have seen

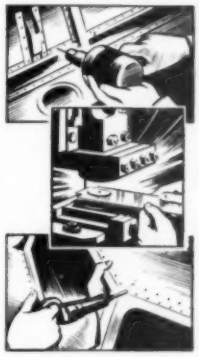
(*Continued on page* 106)

Do You Know What *Up-grading* Means..in Aviation?

—It Means Everything to You... *After You Get Into the Aircraft Industry*

How fast you advance...how far you go...depend on how well you turn out in the aircraft industry's "Up-grading" process. This is a system of testing and developing a man's skill in one type of work after another, "up-grading" him to more and more important duties. Under this plan, your superiors would hope that you would gain all-around proficiency and could then be entrusted with supervision of the work of others. After that would follow the industry's unlimited opportunity to hold posts of greater and greater responsibility, to win prominence, leadership, and success.

If you enter the industry trained to do only some routine hand or machine operation, you must start at the bottom in the up-grading process. IF you perform this one starting job satisfactorily you may be entrusted with a more important task. IF you are able to "make the grade" in the whole up-grading program you may win your first supervisory job. ALL depends on how good your aviation school training was, on how wide a range of skills your school could give you the opportunity to achieve, on how broad and detailed a store of technical aircraft knowledge you were taught. Read below what it can mean to you—in these respects—to be an Aero ITI-trained man.



Operations like these—drilling, riveting, running a punch press—are typical routine, manual labor jobs for which short "job training" prepares you.. This is where you start in aircraft work...where you may STAY ...when you do not have the advantages of broad, thorough training... such as given by Aero ITI.

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Assembly of the various aircraft components into complete planes—including large, all-metal ships—is a standard part of Aero ITI training... giving you priceless experience far advanced over simple operations such as drilling and riveting.

Here you see Aero ITI students—both mechanics and engineers—giving a student designed and built plane final inspection before its first test "hop"... a typical example of how Aero ITI training reaches the ultimate in practical experience.

As an Aero ITI-trained man your up-grading is already well along BEFORE you enter the industry. This is PROVED by the outstanding records of the 3265 graduates employed by 129 firms in aviation. It is the rule rather than the exception that Aero ITI-trained men are soon advanced beyond their starting jobs. Many have gone through the more advanced stages of up-grading quickly—or been excused from it entirely—and soon placed in supervisory posts. Many more have stepped directly from Aero ITI into preferred jobs—responsible jobs such as power plant installation, final assembly, experimental, and inspection.

The superiority of Aero ITI training has also won many graduates jobs with the big airlines...in maintenance work, one of the finest jobs in all Aviation. Aero ITI engineering graduates, too, consistently are selected for the more specialized phases of aeronautical engineering because of their more practical, more thorough training.

Before starting ANY aircraft training, for ANY branch of Aviation, be sure it will take you a long way, that it will bring you real success. These are the all-important reasons you should be satisfied with nothing less than Aero ITI training. For the sake of your whole future, write today, or send the coupon, and get complete information on what Aero ITI training can mean to you.

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The Birdmen's Perch

The editor's chair is a hot seat! Never before in the long career of "The Perch" have we received such scathing letters as have lately been written on the subject of "harder problems." The customers say we are sissys. They say the problems aren't *half* tough enough. And to make their point clearer, they send in problems that really are tough. Can you top this month's? Send 'em in, fellows . . . the more the merrier!

Major Al Williams, alias, "Tattered Wing Tips,"
Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh, Pa.

DEPT. OF INFORMATION

We suggest you cut out the following and paste it in your helmet. It is contributed by Walter A. Biddle, Ground Instructor at Cutter-Carr Flying Service, Albuquerque, New Mexico. Them's words of wisdom, Mr. Biddle!

DON'T EARN YOUR WINGS
Get A Fitted Pair Free From St. Peter

Always take off with a cold motor, you waste so much gas warming the engine.
Don't fasten the safety belt, that's for sissys.
Don't look for other planes in the air, they will miss you most of the time anyway.
Practice your steep turns over the girl-friend's house; she will think you are the cutest corpse.
Always fly into a thunderstorm, it must be interesting for few ever come back after they go into one.
Stretch your glides to the last inch, if you don't reach the spot you will make a nice one anyway.
Your gas gage is always correct, only *old* pilots look in the tank to check.
Pull the nose very high in slips, it gives the ground observers a bad case of the jitters.
When approaching a strange field, sneak in low and straight, it is such a surprise to the local flyers.
When a plane is placarded for a maximum speed, see if you can't squeeze a few more miles out of the old crate.

Don't have your parachute packed every 60 days, that's just a racket thought up by the chute packers.
When taking your girl for her first ride, pull a forced landing; the motor usually catches and what if it doesn't.

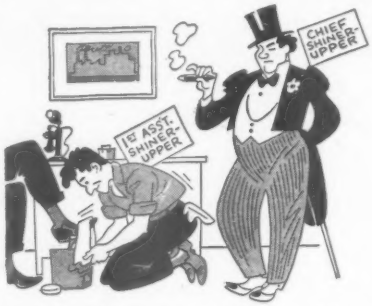
THIS MONTH'S BRAIN TWISTER

Well, here's one of the fellows who thinks the problems should be much tougher. This one is from a Pvt. (Sgt., by now, we hope) at Selfridge Field. Send in your answers, guys, and send in a tougher one if you can!

The pilot of a plane flying North began a turn over an East-West highway maintaining the same bank and altitude throughout a 360° turn. There is an East wind blowing at 30 m.p.h. When the pilot had completed the turn he noticed that he was 500 feet further West along the road. If the speed of the plane was 180 m.p.h. what was the radius of the turn?

WE DO IT UP *EXTRA* GOOD!

Once upon a time we had a shoeshine man here in the office. Not just an ordinary shoeshine man, either—this fellow was very superior. He carried an assistant with him who first shined the shoes. Then our superior boot-black *shined the shine*. Yes, the result was wonderful.



We tell you this because here at Gulf we practice just about the same trick in refining Gulfpride. We *shine the shine*. In other words, we give Gulfpride an extra something with a special refining method of ours—the Alchlor Process. Because we started with the finest crudes, and because this Alchlor Process takes out *more* of the carbon-and-sludge-makers, the results are wonderful—just like the shoe shine.

Ask the next pilot you meet, how Gulfpride has acted in his plane. He'll tell you it's the finest protection an airplane engine could ever get!

THIS MONTH'S WHOPPER

Dear Major:

Being of a rather conservative nature I was loath to discount some of your stories on the merits of G.A.G. To we flyers up here in the bush that liquified dynamite is something we hear a lot about but cannot purchase.

One day last summer we were diamond-drilling a claim on one of Ontario's many land-locked lakes. Our Waco supply ship was a day or two overdue with our supply of gas for the drill motor. Towards evening, however, an American who was touring around in search of some exclusive fishing chanced to drop down on the lake we were operating from. As our gas supply had run out and the drill stopped operating I went down to the shore and started a conversation. When I told him what our situation was he immediately offered us a few gallons of his fuel supply to use until our plane arrived. Up to this time let me add that I had not taken seriously the claims for your "stormy petrol."

Well, we filled up the tank of our drill motor with the few gallons we had borrowed. When I spun the crank, something seemed to snap and the four-cylinder power plant started to whine like a Wright Cyclone on a test block. We were helpless, the only thing to be done was to let her run out.

Now this may sound hard to belive, but in the morning when the commotion had stopped we ventured back to the scene and found a very tired-looking drill assembly relaxing beside a perfectly cut shaft 500 ft. deep and the conventional width. When the stopping crew flew in later and I explained it to them they told me to tell it to the marines. Well, I'm going them one better and telling it to you.

A northern flyer,
Syd. Dunkley
88 Cedar Street,
Sudbury, Canada

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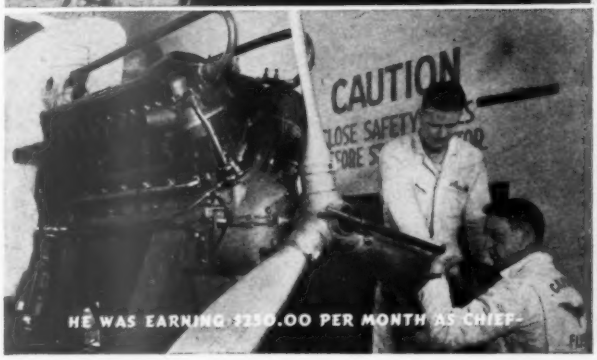

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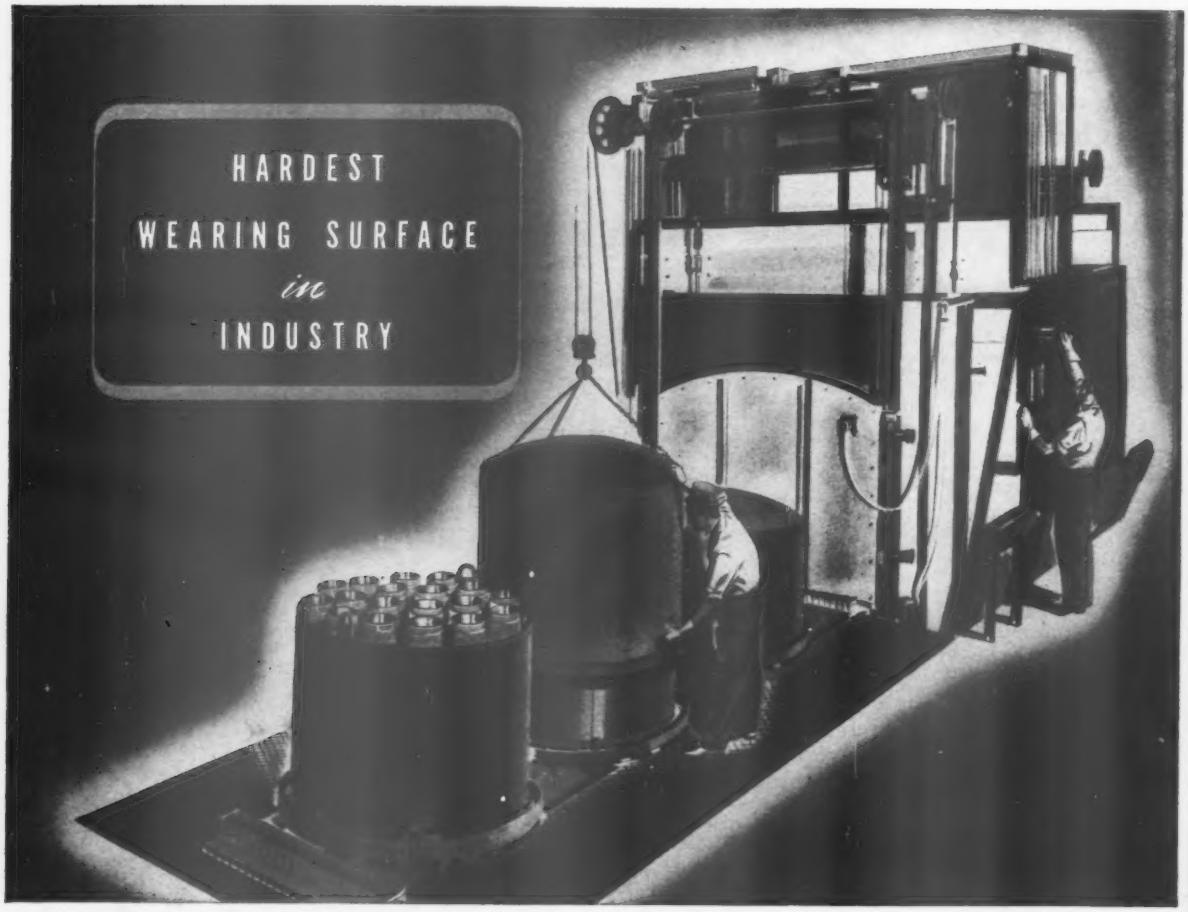

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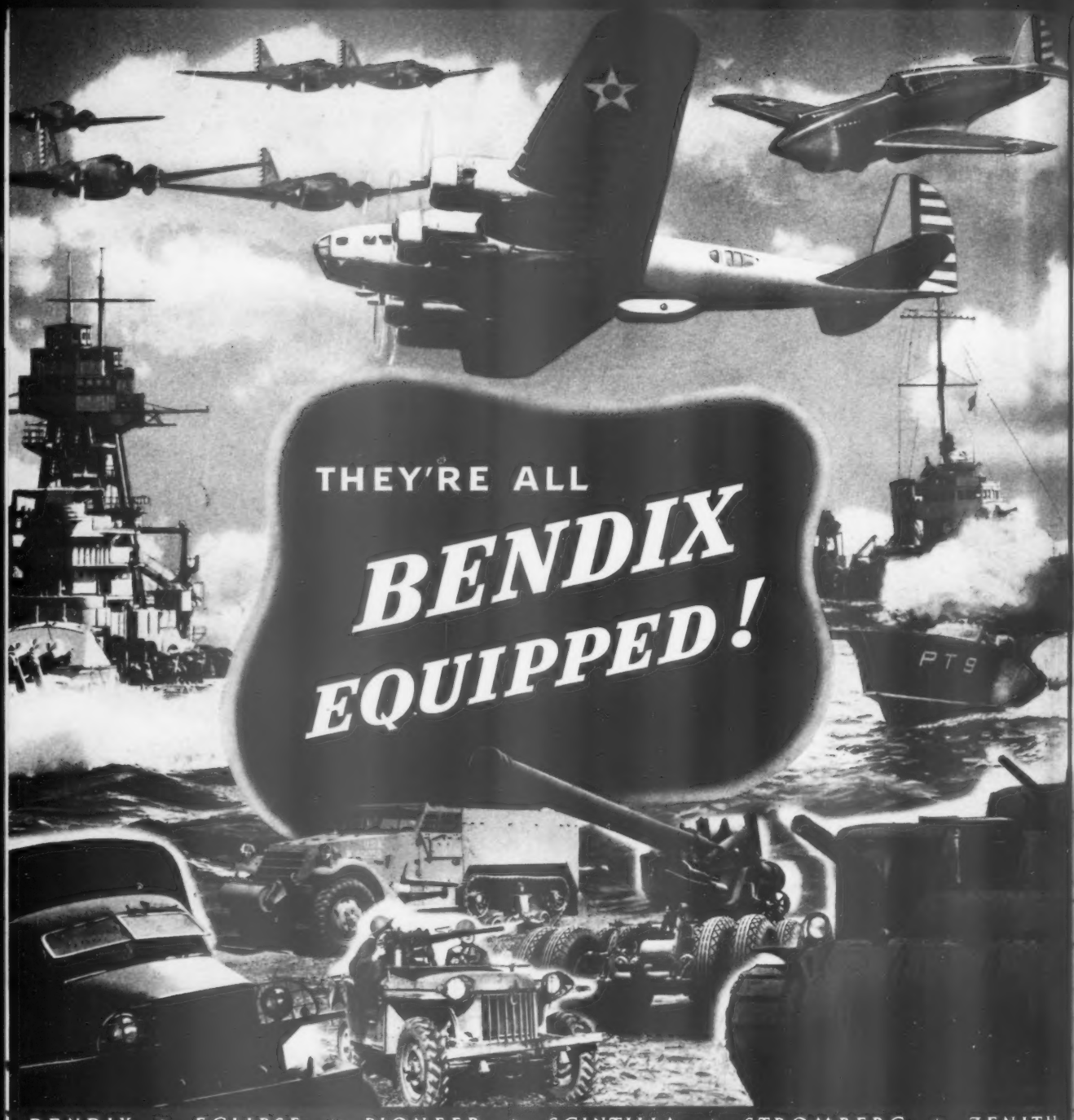

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STOP JAPAN *Now!*

by JAMES R. YOUNG

Constant bombardment of Chunking continues only because Japanese bombers fly over unchallenged.

American sea and air power can halt Japanese aggression immediately if used now, the author contends. He advocates the U. S. call Nippon's bluff.

Secretary of State Cordell Hull (left) and Senator Ellender.

"Several months ago I stated that, before this war was over, our Government would have to engage in war with Japan. I know of no better time than now to do the job."

ALLEN J. ELLENDER
Senator from Louisiana

JAPAN'S threat in the Far East is perpetuated by an Axis plan to keep our Pacific Fleet from being released for immediate convoy duty in the Atlantic. America *can* and *must* call Nippon's bluff and free our Naval squadrons in the Pacific, if we are to get the necessary aid to Britain in time. This is the hour to act. Japan is vulnerable to an attack by our Army and Navy air units operating from bases in Alaska, the Philippines and even China. Almost single-handed our air power, as it now stands, can cut the lifeline of Japan's only real menace —her navy—destroy her crowded cities, demoralize her army and render the nation worthless to the Axis.

Just as the German war machine smashed through the Low Countries and pinched the Balkans the Nazis plan, by using the Japanese as a stumbling block to keep America silent and busy with "peace negotiations" and afraid to use force against the Land of the Rising Sun. In this way, Japan can become the key pivotal point whereon the Axis can whirl to threaten the United States. The first part of the plan is to eliminate Russia.

Already Japan is organizing White Russians in Harbin, Tientsin and Shanghai in preparation for a puppet regime in Siberia. As we ship planes and vital war supplies to Russia through Siberia, they are being immobilized in a sense

James R. Young knows Japan and its people as well as any American could know them. For 13 years he covered the Orient for the International News Service in Tokio. Born in Rushville, Ill., he attended the University of Illinois, started his newspaper career with Scripps-Howard. He now is touring the U. S. lecturing on his experiences in Japan.—Ed.

by increased Japanese forces numbering nearly 1,000,000 in Manchuria. When and if the Soviets should be overcome by the so far victorious Nazi machine, America will be in a tough spot. Japan will be free to go south and, jointly with Germany, bludgeon China through a pincer move which will be followed with a push around to India, joining in Africa the German thrust through the Balkans. The only safe action for the United States to take to prevent such a move is to strike *now* at Japan with the full force of our air, sea and land forces.

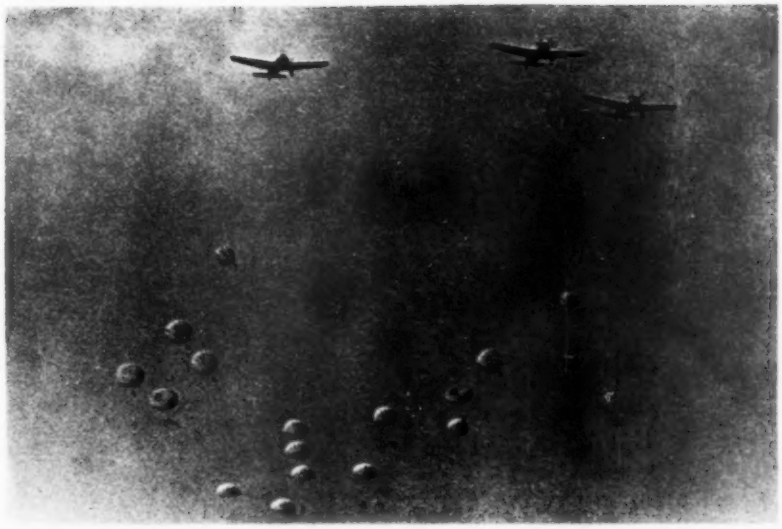
If we permit the totalitarian countries to control the Far East, we are inviting Japan to threaten our Pacific Coast, just as Hitler's futuristic plan is to attack our Atlantic shores and disrupt Western Hemisphere solidarity. But, if we weaken Japan now and, at the same time, the German force is defeated in Europe, then the democracies can re-establish in Europe and the Orient.

Right now the Orient is an international boiling pot. If Stalin should quit or sue for peace with Germany, we would immediately face Japan. Knowing the vacillations of the Kremlin in the past, I would not be surprised if, because of our indecision to act in the Far East, the Soviet would turn, under forced collaboration with the Axis, against the United States and Great Britain. This would put China out of the picture. The Philippines would be joined with Thailand to Axis Japan. Singapore would become isolated and our channels for rubber, mica, tungsten, manganese and tin would be cut off by Japan's southward knifing. If we permit Japan to continue we will find ourselves in a perpetual state of agitation. If we do not take the initiative, we will be forced to "bail out" with our Navy in the Pacific, leaving that ocean under Nazi-Japanese domination.

Our job is to thwart Japan's encirclement. We must give her "Hobson's choice" and, if the Japanese do not accept, we must drop our compromise policy and face the dilemma with firmness and force.

There are three trends of thought in America today: (1) Japan cannot attack America. (2) The United States cannot defeat Japan. (3) By using our combined air power and fleet, we can eliminate any further "mug-wumping."

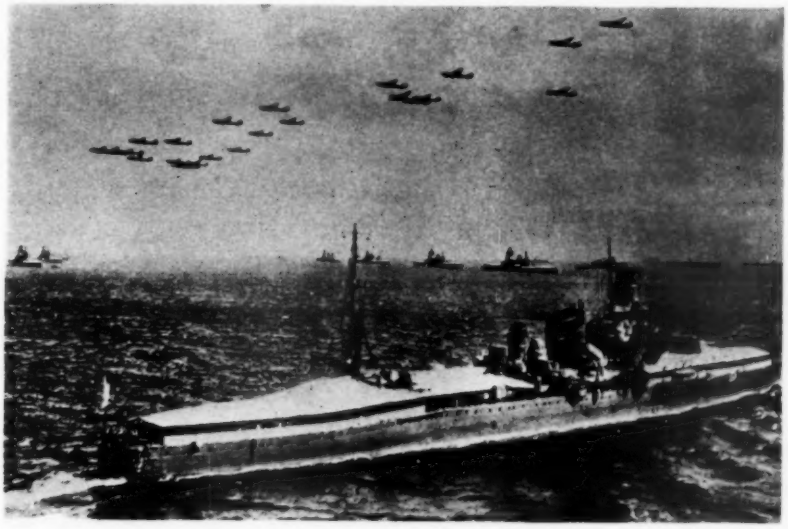
The possibility of a Japanese attack on

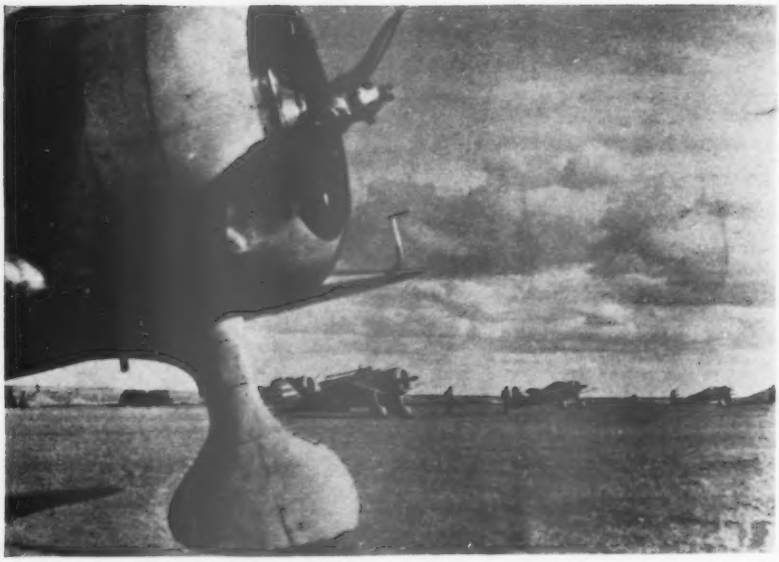


Only within the last month or two have the Japanese used parachute troops in China.

Naval pilots above are said to be better flyers than those in the Japanese army.

U. S. Navy experts long have considered Japanese air and sea power third-rate.





These are latest Japanese fighters, can be outflown and outgunned by old U. S. types.

Navigation is an important subject at Army air school. Formulas must be in English.

Mitsubishi aircraft factory at Nagoya is one of Japan's largest and most vulnerable.

Emulating Soviets and Germans, Japanese girls now are learning to fly in gliders.

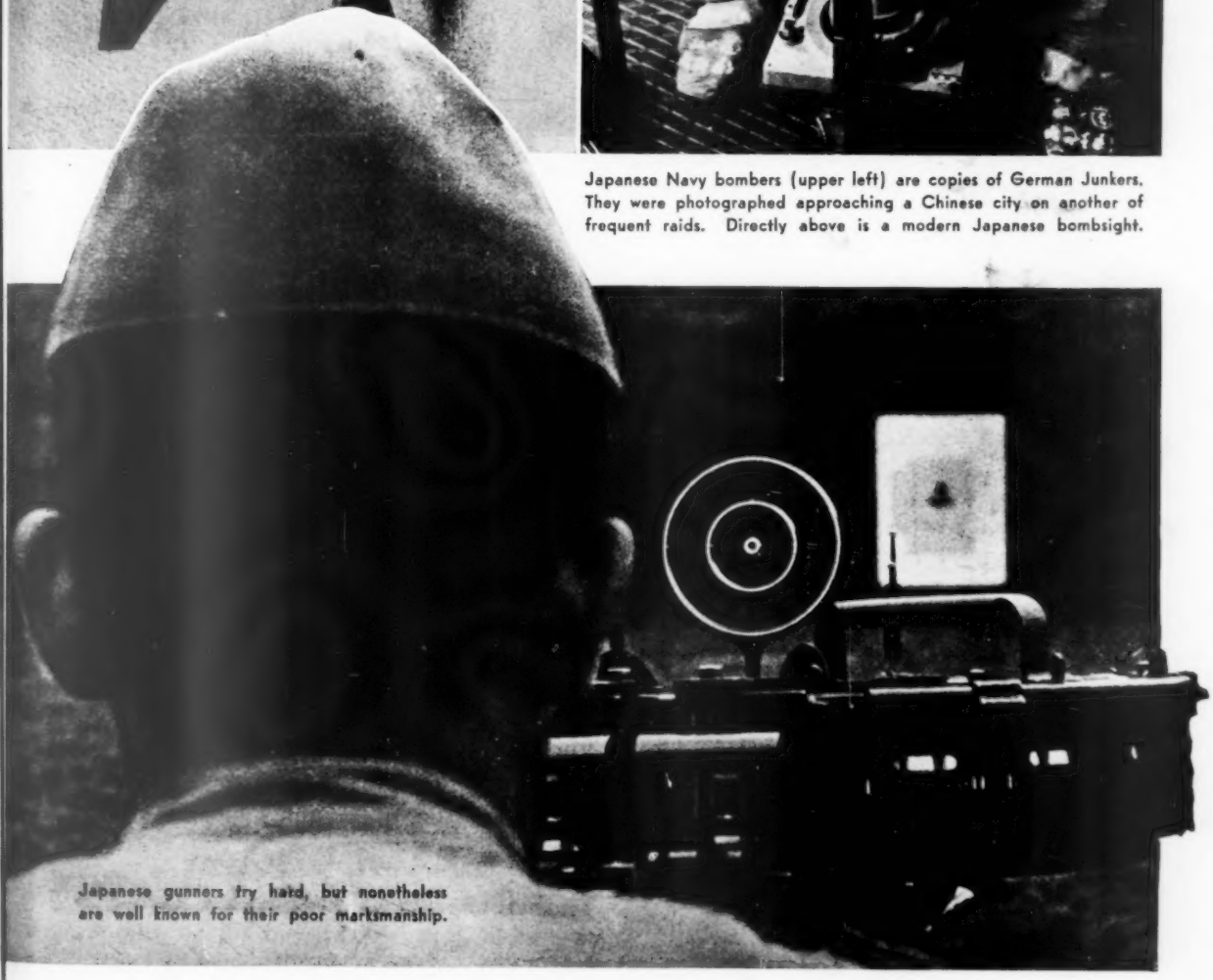
our shores was minimized by Russia's turn against the Axis. Until that time, Japan was in a position to encircle the Philippines. Now Japan is encircled on the north by the Soviet and on the south by strengthened American, British and Dutch forces—and by China in the middle.

Virtually, Japan is caught in a web of modern citadels of air and sea power. She is 1,500 miles from Dutch Harbor, 500 miles from Russia's Komandorski Islands. Her southernmost navy post is Camranh Bay, 2,500 miles away. Her South Sea mandated islands in another direction are 2,000 miles distant. Less than 1,300 miles away from her industrial centers near Tokio, at Alaskan air bases, are U. S. Army Air Force bombardment groups, standing ready for action. And facing her Gibraltar of the Pacific, Formosa (largest island in the Japanese group), are strong U. S. land, sea and air forces in the Philippines. Japan could not withstand the highly developed and speedy striking ability of America's new Pacific might. She would quickly crumble.

(*Continued on page* 58)

Student Japanese air officers above are attending lecture on aerial bombardment.

Japanese Navy bombers (upper left) are copies of German Junkers. They were photographed approaching a Chinese city on another of frequent raids. Directly above is a modern Japanese bombsight.



Japanese gunners try hard, but nonetheless are well known for their poor marksmanship.

These Indies warplanes are Dorniers, Martins.

The Netherlands Indies ARE READY

As commander of the air arm of the Royal Netherlands Indies Army, Major General van Oyen is largely responsible for the welfare of his homeland's fabulously wealthy colony. An officer in Netherlands army since 1911, he learned to fly in 1936 at the age of 47. The old English trainer in which he learned hangs today in an Indies hangar as a souvenir. He now is in the United States on a mission for his homeland.—Ed.

by Maj. Gen.
L. H. Van OYEN

The chief of the Dutch air force in the Far East describes preparations they have made to resist an attack.

LIKE the scattered pieces of a jigsaw puzzle, the island empire of the Netherlands East Indies stretches in semicircle from the northern shores of Australia to Southeastern Asia. Out of the rich earth of these South Pacific islands come inexhaustible rivers of free-flowing oil. From the jungles comes rubber and from the mines tin—all materials with which to make war.

Almost dead north lies Japan, an island empire too, but without a trickle of oil and hardly a rubber tree—and no tin.

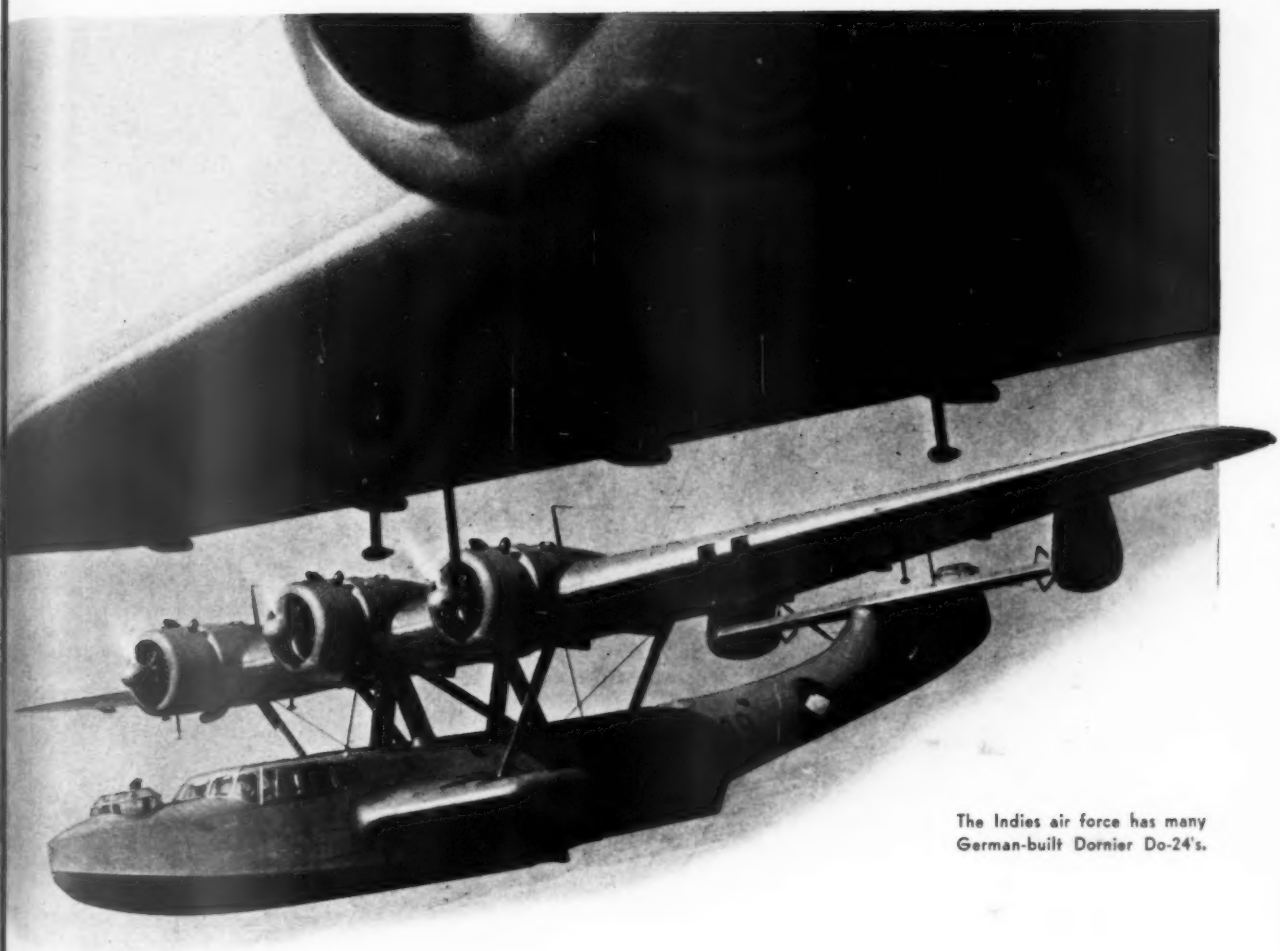
Japan has been in a war for four years, now, and the warlords of that country can see bottom in the gas tanks of their warplanes, their army motors and the fuel tanks of their navy. There is a yearning in the breasts of the warlords for those Dutch oil wells 2,800 miles to the south and right in their own ocean. They could use the other wealth of the Indies too.

Most of all, warrior Japan needs oil—desperately. The United States, Great Britain and the Netherlands have all rung the curfew. There are no gas stations open, in all the world, to the Nippon war machine. Yet China still is unconquered, indeed fighting back with increasing ferocity and the other two of the Axis triumvirate need all the oil they can get for themselves.

Japan already has made her first successful southward march into Indo-China to draw within 700-odd miles of the Dutch Indies. It still is in doubt whether her claustrophobia will lead her against Thailand (Siam) right next door, or on an invasion of Malaya and the Indies next.

In this hair-trigger situation the United States has a tremendous military and economic stake. In 1940 the U.S. took 61 per cent of all the islands' rubber ex-

The Dutch navy is speedy and light.



The Indies air force has many German-built Dornier Do-24's.

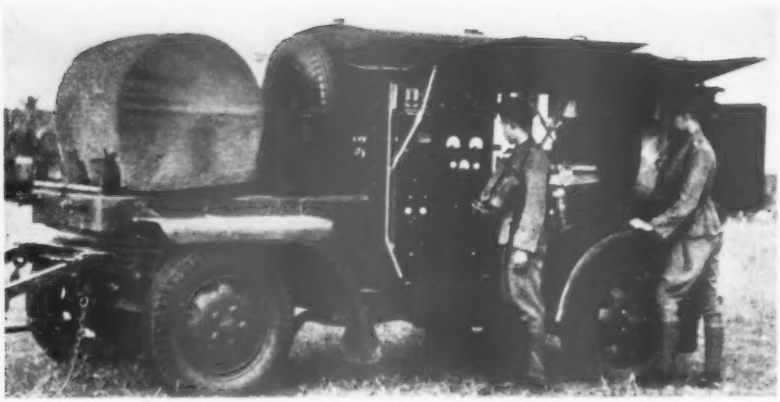
ports, 64 per cent of their tin and 67 per cent of the manganese ore production. These purchases, which amount to $25,000,000 a month now, are increasing and almost every dollar's worth is going into this country's defense effort. The United States wouldn't get an ounce of these if the armies of Japan overrun the Indies as Axis Partner Hitler has overrun Holland, their mother country. Although it probably would not cripple the nation's defense production it would slow it down a whole lot.

Now, look at a map. Directly in the path of a Japanese descent on the Indies lie the Philippines. Its hardly likely that your Uncle Sam would stand by in benevolent inaction if these islands were in the front line of a war. However, if Japan's war party overcomes its conservative opponents (this just happened)—they will find that an invasion of the Netherlands islands is anything but a simple military excursion. With Dutch thoroughness we are preparing for the worst. There are many natural deterrents to invasion in our islands and we are backing these up with all the military weapons we can buy.

Recently delivered to Dutch were these Lockheed "Lodestar" troop-carrying transports.

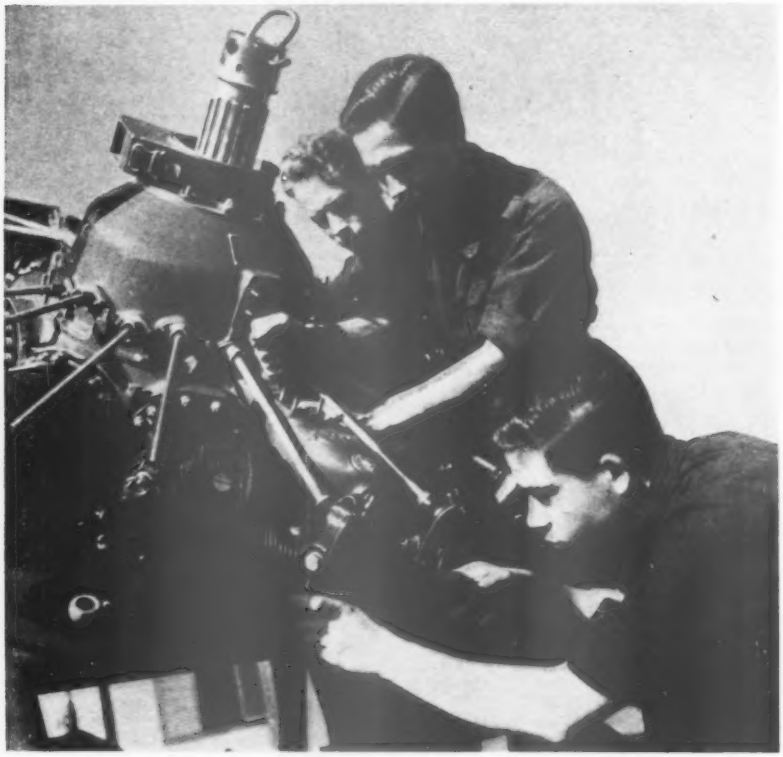
Already in service are Curtiss-Wright CW-21 interceptors, answer to surprise attacks.

Netherlands Indies air force has some of the world's best pilots, native and white.



This is one of specially-designed mobile Army air force radio stations, for use on the many secret improvised military air bases scattered around Java and other Indies islands.

Dutch mechanics have been given a thorough schooling on modern engines. Those below are overhauling an American Wright, many of which are used on bombers and fighters.



But—and this is important—our purchasing commission in New York, with about $500,000,000 it is willing and anxious to dump in the laps of American airplane and arms manufacturers, is having tremendous difficulty in converting even a fraction of that into weapons. It seems Britain, and now Russia, comes first. There can be no quarrel about aid to both of these valiant countries, but it is possible the United States can prevent an outbreak of hostilities in the South Pacific—an area of great importance to America—with adequate aid to the Netherlands now.

We are not asking for materials we can't use. We Dutch don't buy things we can't use at once, or in the immediate future.

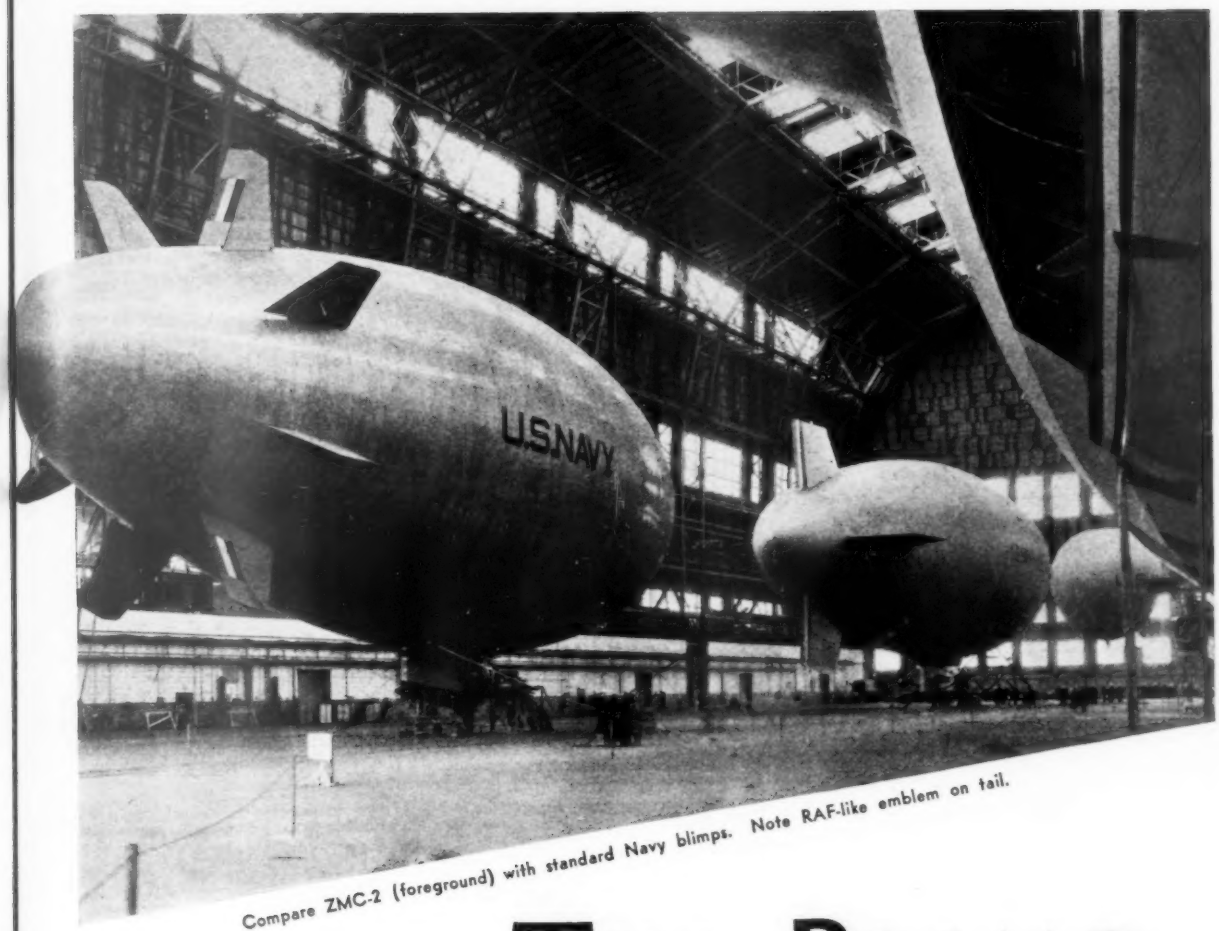
With respect to how we use the weapons the United States sends us: a group of U.S. Army Air Forces observers visited Java a few weeks ago and said they were astonished at the efficiency of our air forces, both army and navy. They remarked that both operate in almost identical detail with the United States air arms.

It is a military secret how many planes and airports we have guarding the 3,000-mile fan of our islands from the western tip of Sumatra to the frontiers of New Guinea, but I notice most of your observers over here place the number at between 750 and 1,100. I can't commit myself on that but I can outline our rather elaborate plans of defense for which we have been building solidly since 1936.

The Netherlands East Indies has two air forces, army and navy. The army air corps, which I head, is equipped with Ryan trainers, made in the United States, a formidable array of Brewster *Buffalo* fighters, Fokker reconnaissance planes (now used only for training), and Curtiss interceptors, known over here as the CW-21. We also have many Curtiss P-36 fighters.

In addition, the Navy has some Dornier flying boats, built in Germany before the war; Consolidated *Catalina* and Vought-Sikorsky flying boats. The first two of a series of Douglas boats arrived in the Indies in September from the west coast of the United States, having been ferried across the Pacific. Next year ad-

(*Continued on page* 70)



Compare ZMC-2 (foreground) with standard Navy blimps. Note RAF-like emblem on tail.

TIN BLIMP

by JOHN W. HIGGINS

Still serviceable but flown only occasionally, the Navy's once-famed ZMC-2, only metalclad on earth, recently passed its 12th anniversary.

OLDEST operating rigid airship in the world is the Navy's metalclad ZMC-2, which, last August 19, completed 12 years of successful operation at the Lakehurst Naval Air Station. Seldom flown in recent years the airship, since its first flight from Grosse Isle Airport, Detroit, Mich., has been in the air approximately 2,500 hours, covering more than 100,000 miles.

The unique airship was born in 1921 when a group of automotive engineers pooled their ideas to modernize the rigid dirigible and make it all-metal, like the hull of a seagoing vessel. Among the men were Ralph H. Upson, chief designer and professor of aeronautical engineering, University of Michigan; Carl B. Fritsche, president of the Aircraft Development Corp., which built the airship; Charles F. Kettering, director of General Motors Research Laboratories, and W. B. Mayo, Ford Motor Company chief engineer. These men were aided by Dr. William Hovgaard, professor of Naval Design and Construction, M.I.T.; and Dr. Herbert C. Sadler, dean of engineering, University of Michigan; and several experts of the Bureau of Aeronautics, Navy Department.

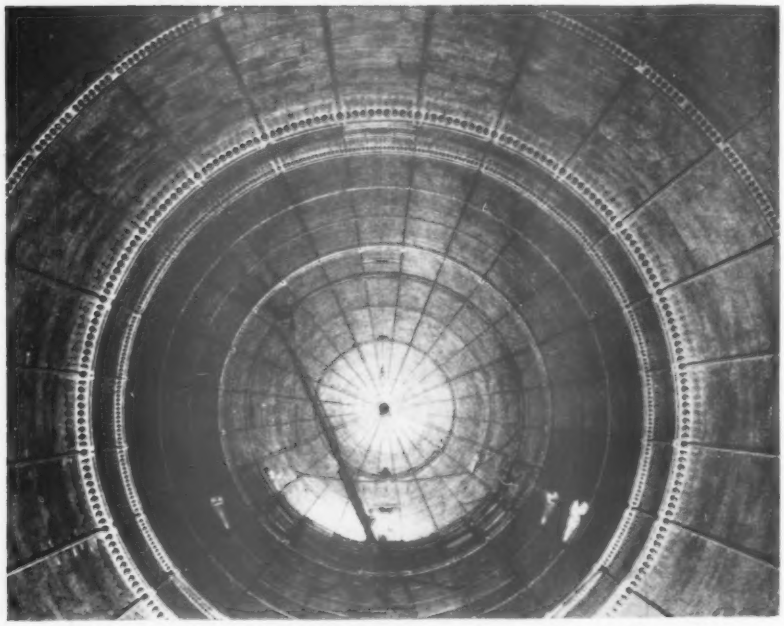
The major problems of metalclad construction and design investigated were weight, method of erection, covering application, gas tightness, hull corrosion, vibration and its effect upon the gas tightness of the seam. Each was solved individually and thoroughly tested in laboratories before actual construction was considered.

The Navy became interested in the ship for the purpose of research into the feasibility of building all-metal airships of American design and orginality.

It was decided to erect the hull vertically in sections. Using this method, the hull plating was assembled from a series of transverse rings, in vertical positions, and parallel to the floor. Each section, suspended from the hangar roof, could be raised easily and the successive rings put into place, thus lifting the section with the addition of each ring.

After assembling a hull section, the internal framing was expanded tightly into place and riveted to the plating. When each section was complete it was turned horizontally and joined with others to form the complete hull.

Rivets joined the thin sheets of hull plating. An automatic riveting machine was developed employing a new principle. In its operation, three strands of wire were fed like threads into the machine and three rows of rivets were "sewed" simultaneously. The machine sheared off the wire, rivet length. The tiny wire sections were punched through the two sheets of metal and the revolving cams



This view of ZMC-2's interior clearly shows the thousands of riveted plates. The entire hull took 3,500,000 rivets, 5,000 per hour inserted by a novel riveting machine.

headed the rivets. Spacing of the rivets was mechanical. With this machine, two men were able to accomplish as much work in a given time as 100 men working by hand. It inserted 135 rivets per minute, about 5,000 per hour. Approximately 3,500,000 rivets of .35 inch diameter were used in the hull of the ZMC-2.

The original specifications for the ZMC-1, predecessor model of the present ship, provided for a hull covering of duraluminum .008-inch thick. It was the first time sheets of this thickness had been rolled, and their resistance to corrosion was unknown. When the hull of ZMC-1 was one-quarter completed, exposure tests made by the Bureau of Standards revealed corrosion and embrittlement of the duraluminum plating.

Six months' exposure showed serious deterioration resulting from crystallization; evidence enough that this was not a safe material and construction was halted. This gave an opportunity to test the discarded stern to destruction in order to prove design theories with a full size section, 29 ft. high and 34 ft. in diameter, weighing about 400 pounds.

The lower edge of the vertical section was embedded in a concrete ring weighing 56,000 pounds and made airtight by a water seal at the bottom. It was then inflated with hydrogen and tested for gas tightness. Samples of gas, to determine its purity, taken at intervals from different places on the hull, an external soap film test and the use of leak detectors, confirmed theoretical gas tightness beyond expectation.

One feature of this test was the behavior of the stern section with internal pressure reduced to approximately .3-inch below atmospheric pressure. Hydrogen was first displaced with air for safety purposes, and artificial suction created. Naturally the metal covering folded in between the longitudinal girders, producing long wrinkles and the longitudinals straightened out, losing their convexity between transverse frames. Many folds in the plating were so sharp that it seemed the metal was permanently distorted and that re-introduction of pressure in order to restore the plating to its original contour would cause a fracture or failure. But when pressure was raised to two inches above atmospheric, the stern section's shape was perfectly restored. It was impossible to find where the buckles had occurred.

During this experiment some of the longitudinal girders were broken by the strenuous bending. In his report on this punishing test, C. P. Burgess, U. S. Navy aeronautical engineer, said the behavior of the structure indicated, although some longitudinals failed, the stressed skin was effective in supporting the internal structure against complete collapse and failure.

Next, the same hull section was subjected to a distributed side load of 2,650 pounds, approximating a bending condition in excess of that occurring in the actual ship. Interior pressure was varied from 0.3-inch of water to plus 13.0-inches of water, and the test indicated a longitudinal stress safety factor of 9.0. At the high pressure of plus 13.0-inches, the 400-pound section actually lifted the 56,000-pound concrete ring from the floor, breaking the water seal and releasing the compressed air with a sudden rush. After this demonstration of strength the builders decided on another try using "Alclad" covering, a creation of the Aluminum Company of America, which passed superior resistance tests to corrosion. The new metal was a "duraluminum sandwich," the "meat" being plain duraluminum coated on each side with pure aluminum. The aluminum coating served as a guard against corrosion of the core, quite similar to the action of zinc on steel.

In 1928, after the experiments with parts of the ZMC-1 had been thoroughly studied, construction of the all-metal ZMC-2 was started. The first rivet was driven in the bow section on March 7, 1928; the ship was completed August 10, 1929.

The ZMC-1 and ZMC-2 together cost $750,000. The Navy paid $300,000, and the company took a $450,000 loss. Before a congressional committee in 1926, the company's engineers had agreed to go 50-50 with the Navy on the expense of the project with the stipulation that if it cost more than $300,000 they would bear the expense.

Trial flights demonstrated the soundness of the theories involved in the ZMC-2. The ship was first flown August 19, 1929, but it did not fly to Lakehurst until September of that year when it was officially accepted by the Navy Department.

Completed, the ZMC-2 had a gas volume of 202,000 cubic feet. She was 150 feet in length, 53 feet in diameter. Gross lift was 12,200 pounds, height, 64 feet, range 600 nautical miles; speed, 52 knots or about 60 m.p.h.

When the ship arrived from Detroit at the Naval Air Station, Lakehurst, there were bullet holes in its all-metal hull. Capt. William Kepner of the Army, who flew the "tin bubble" was unaware of the holes until the ship was in its hangar. The Navy said "playful kids" had shot at the ship enroute.

The Navy has used the ZMC-2 only for experimental purposes. Each year at Lakehurst on its birthday, August 19, the ship is flown.

The amazing thing is that after 12 years ZMC-2—the only all-metal airship in the world, still can operate and does.

END

Army Sees Autogiro

A SELF-CATAPULTING, all metal Pitcairn-Larsen autogiro—model PA-36—which lands and takes off vertically has been undergoing Army demonstrations at Bolling Field, Fort Bragg, Fort Benning, Fort Knox and Fort Sill. The jump take-off, giving vertical ascent and so requiring no run whatever, is considered a valuable addition to the autogiro's ability to hover and fly at low speeds.

During the demonstrations the ship landed and took off under adverse weather conditions from a hilltop with maximum available landing area of 35 by 45 feet. Operations also were carried on from plowed fields, rocky terrain and rain-soaked and swampy areas, as proof of the plane's military value under actual combat conditions.

Meteorological Film

HOW weather factors affect flying is shown in a recent Boeing School of Aeronautics film. It illustrates the movement of air masses, cloud formations and the like. The Army, commercial airlines, and the Weather Bureau are using copies of the film, which has proved remarkably effective in teaching students weather fundamentals.

The Langley, above, is first twin-engined plastic plane. Finish is unusually smooth.

'Cooked' Craft

by J. N. Terry

The trend toward plastics to conserve on precious defense metals has produced a new plane. This ship is made entirely of plastic plywood.

THE new molded plastic-plywood, four-place, twin-engined Langley low-wing lightplane may be one answer to production bottlenecks and priorities. Its all-wood construction short circuits priority rulings and may mean cheap, quick production.

Named for Samuel Pierpont Langley, the ship—it still is experimental—has a 142 m.p.h. top speed on two 65 h.p. Franklins. Cruising speed is 125 m.p.h., landing 46 m.p.h. Take-off requires only 200 feet according to Martin Jensen, barnstormer and Dole air derby flyer, the ship's designer.

The Langley is not just another plywood airplane. Instead of bending prefabricated sheets of plywood and attaching them to a framework previously constructed, thin strips of plastic treated Honduras mahogany veneer are formed over a wood mold into one integral unit, comprising both structure and skin. Cheaper, commoner woods can also be used. While still on the mold, formed parts, even entire wing panels and half fuselages, are placed in a steam pressure chamber causing the plastic to soften, binding the various layers of veneer. When cooled, the result is a tremendously strong shell that requires a minimum of structural members. It is impervious to heat, cold and dampness. The material has been tested satisfactorily in temperatures ranging from 40° below to 200° above zero. It does not fatigue like metal and resists corrosion by acids, alkalis and salt water.

But what has all this to do with bottleneck bugaboos? Simply this: unlike aluminum, veneer—the Langley's basic material — is plentiful and relatively

(*Continued on page* 66)

A secret process "bakes" the airplane. In cockpit is Martin Jensen, ship's designer.

BERYLLIUM:
Heart of Tomorrow's Airplane

Beryllium-copper alloys are used today in aircraft construction. Above, at left, is a high-strength non-magnetic bolt. Diaphragms used in aircraft instruments (center), and aircraft carburetor spring.

By

CHARLES T. MALONE

Metallurgists are trying to alloy beryllium with aluminum inexpensively. When they do, it may revolutionize aviation.

BERYLLIUM is the world's lightest hard metal. Alloyed with pure aluminum, producing a lighter and stronger alloy than duralumin, it may revolutionize our aviation industry. Experts claim such a metallic combination will reduce present wing loadings by at least half, provide a tougher, lighter covering for wings and fuselages, serve as protective armor and, by reducing weight, help to increase speeds up to 600 m.p.h. in level flight.

Like gold, beryllium is one of the 92 elements which, separately or in combinations, compose everything in our known world. The metal comprises about 0.005 per cent of the earth's crust, has a specific gravity of about 1.8 and is about two-thirds the weight of aluminum. It is the fourth lightest element, exceeded in lightness only by hydrogen, helium and lithium—two of which are gases. In appearance, pure beryllium resembles aluminum.

The discovery of beryllium dates back to 1797, when a Frenchman named Vaquelin discovered it and called the metal glucinium because of its sweetish taste. During his experiments Vaquelin noticed that emerald, aquamarine and beryl all weighed the same and that, after the elimination of the then-known elements, the residue from these three minerals was a white powder with a sweet metallic taste. He called it glucinium, a name which the British have kept to this day. In 1825 a German named Wohler, experimenting with beryl, called the substance beryllium. Because it was found in jewel-grade beryls that had been crushed to powder, beryllium for many years was deemed too expensive to be used as an alloy with other metals. This probably accounts for its being hidden for so long.

Commercially beryllium is obtained from beryl, a mineral found in all of our eastern seaboard states from Canada to Georgia, in North and South Dakota, in Wyoming, Nevada, California, Arizona, New Mexico, Colorado and Utah. Despite this apparent plentiful supply, there are only two American companies which produce beryllium. One, only a few months ago, established a small plant to experiment with a new recovery-process. Its production capacity is only 200 pounds per day or 83,000 troy ounces per month—a million ounces per year. The other beryllium-producing concern, located near Telluride City, Colo., produces some 2,500 pounds daily, sells it for 27 cents a pound, or at about twice the price of pure aluminum. The United States imports

Beryllium-copper wire is used extensively in aircraft instruments. The beryllium gives added strength and increases conductivity.

large quantities of beryllium from other countries, having purchased 805 short tons in 1940—a record—value at $23,865, from Argentina, Brazil and the Union of South Africa. In prior years America imported beryl from Russia.

Beryl usually occurs in columnar crystals hexagonal in shape, of various lengths and widths, sometimes capped with a pyramid. In color the crystals range from pure white or colorless to golden-yellow, pink, bluish-green or emerald-green. It is harder than quartz. It has a specific gravity of 2.75 to 2.8—that is, it weighs about 2¾ times what a similar volume of water would weigh. Some of its crystals are transparent. Beryl is insoluble in acids and it is usually identified by its hardness, color, hexagonal crystals and weight.

Usually found in pegmatite dikes or veins, beryl is associated most commonly with feldspar or mica. It is easily discernible from the rocks with which it is associated. It is mined in small quantities. Sorting is done by hand after which the ore is crushed, ground up, mixed with sodium silica fluoride or sodium fluoride and roasted. During this process the sodium and fluorine combine with the beryllium and, when leached out in water, only the beryllium goes into solution, the other minerals and elements dropping out. When caustic soda is added to the solution beryllium hydroxide is precipitated, and this, when dried, is a white powder resembling talcum. This beryllium oxide is treated with chlorine, forming a compound called beryllium chloride which is dissolved in molten sodium chloride, forming the beryllium flake. The whole process is similar to that used in producing aluminum.

Beryllium, thus produced, is alloyed with copper and with nickel, about two per cent beryllium to 98 per cent either copper or nickel making the best product. Springs made from these alloys will expand and contract from 15 to 20,000,000,000 times before breaking, whereas springs made from the best spring steel will break after about 3,000,000 vibrations. Beryllium alloys have great strength, resistance to wear, excellent electrical conductivity, are non-corrosive and non-sparking. Because of these qualities, the alloys are being widely used in the airplane manufacturing industry.

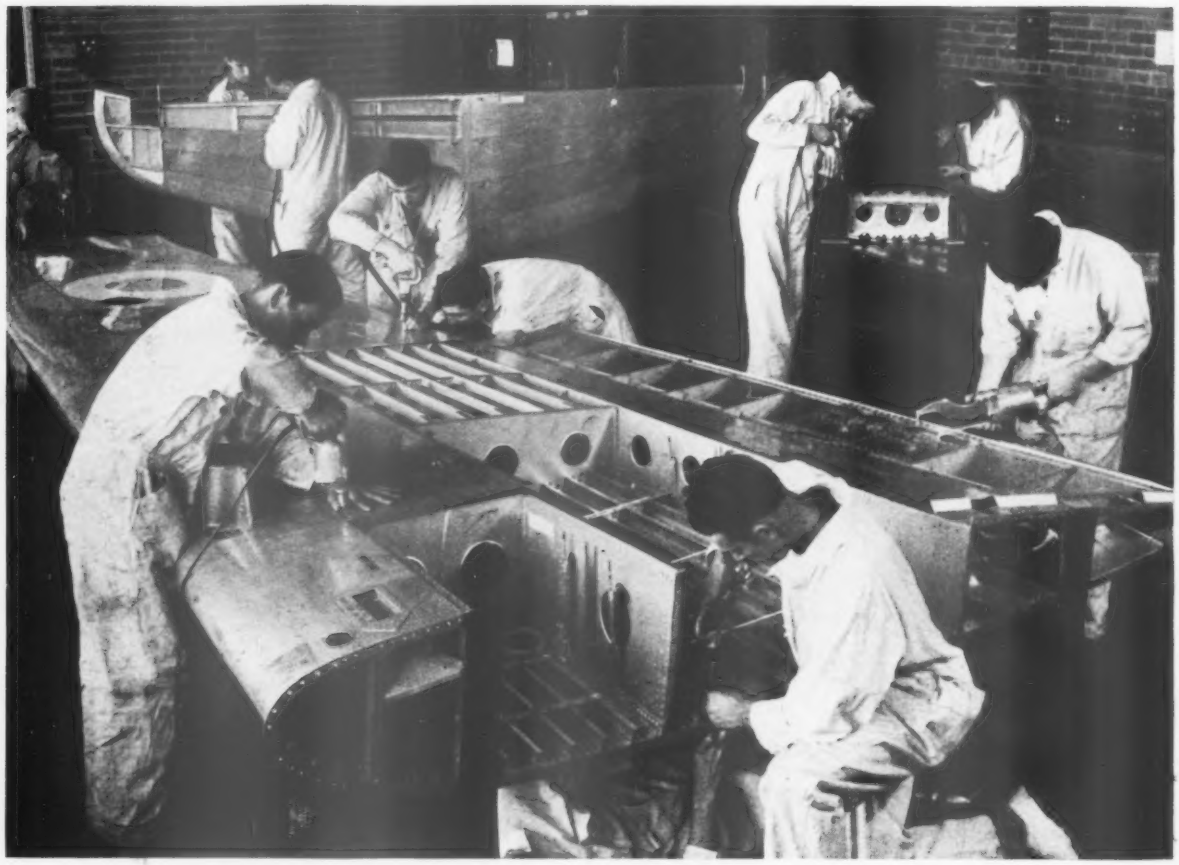
One such alloy, called beralite, has been successfully produced by skilled metallurgists in this country, who claim their product is lighter than duralumin, as strong as good steel and comparatively non-corrosive. But beralite still is very much in the experimental stage. Its production cost is tremendously high and lack of interest in the product, by both military and commercial aviation experts, has held back private capital from further experimentation. But the picture is changing in the fact of the present emergency period. Government officials and military authorities are becoming interested, since it has been reported that Germany is making wide use of beryllium in its fighting planes and also is trying—perhaps already has—perfected the aluminum-beryllium alloy to a great extent than have our own experts.

The effort to alloy beryllium with aluminum is not new. In 1929, Andrew J. Gahagen, president of the Beryllium Corporation of America, employed metallurgists to solve the problem. His experts succeeded in alloying small amounts of beryllium with copper and with nickel, greatly increasing the hardness and tensile strength of both. An alloy of two per cent beryllium and 98 per cent copper, for example, produced a metal so hard that it withstood a pull of 185,000 pounds per square inch, as compared with 53,000 pounds per square inch for duralumin. Beryllium-copper was so hard that it punched a large hole in a piece of bakelite die steel when pressed into it cold under 400-ton pressure. But these beryllium alloys, which are two to five times stronger than duralumin, are from three to four times heavier, making it impractical to replace duralumin in aircraft either with beryllium-copper or beryllium-nickel alloys. An aluminum-beryllium alloy, when it is perfected, will be even lighter than duralumin and therefore excellent for aircraft construction.

Early experiments with beryllium-aluminum alloys consisted of either alloys with 50 per cent beryllium or alloys with less than one per cent beryllium. In 1928, the Aluminum Company of America conducted tests that proved alloying beryllium with aluminum or with aluminum-

(*Continued on page* 94)

PREPAREDNESS TECH



Students apply their knowledge in shops. This group works on French Curtiss "Hawk" wing and stabilizer.

by SPENCER NIXON

Qualified aircraft workers are turned out by this unique high school. Cities in all parts of the country are adopting the idea.

ONE of the most unique high schools in the country is Burgard Vocational High at Buffalo, N. Y., where youths are being taught highly specialized trades that will fit them for vital defense jobs in the aircraft industry. The school is turning out qualified welders, sheet metal experts, mechanics, draftsmen and other skilled laborers for the expanding aviation program. Its basic idea is spreading to other cities throughout the country.

"We have shifted into high gear," said William B. Kamprath, principal, referring to the cooperation between education and industry upon which national defense is based.

"While we don't make pilots out of students here," continued Kamprath, "we do turn out some mighty fine skilled factory men."

Personnel directors and prominent executives of both Bell and Curtiss-Wright plants are heartily in accord with the dynamic educator's statements. Guy W. Vaughan, Curtiss-Wright president, said frankly that the location of his company's new bomber plant at the outskirts of Buffalo, and immediately adjacent to Buffalo's airport, was influenced to a great extent by the splendid educational facilities available in Buffalo and the numbers of skilled men trained there.

During the last 10 years, 92 per cent of Burgard's graduates were placed in the aircraft industry in Buffalo and other localities; eight per cent went to higher schools of learning or to work in allied lines.

Admittance to Burgard is no easy matter. About 525 boys are disappointed every term because they fail to meet rigid requirements set forth by the board of education. Only 125 applicants are lucky enough to enter, having been hand-picked by the registration committee.

Each student's background is investigated to determine whether his family's circumstances will permit him to complete the full four-year course. If ap-

proved, he is then examined for natural aptitudes and asked to explain his ultimate goal in aviation. His scholastic record must show that he was graduated in the upper third of his class. Mental and physical tests conclude the entrance examination.

Burgard offers other courses in printing, auto mechanics, machine shop work and allied automobile lines—but aviation, with its far-flung opportunities, is the most popular.

Aircraft construction and repair, aircraft engine repair, aircraft welding, aircraft metal and machine work, aircraft electrical work, meteorology and air navigation are among subjects offered.

One-half of each school day is devoted to practical shopwork, one-fourth to the study of trade drawing, mathematics and science (as related to aviation) and one-fourth to English, history, civics and economics.

The following four-year shop Regent's-approved course in aviation was adopted in 1930 when the school opened.

FIRST YEAR:

1. Airplane Construction and Repair I. Time: 10 weeks.
2. Aircraft Engine Repair I. Time: 10 weeks.
3. Aircraft Electrical Work I. Time: 10 weeks.
4. Aircraft Metal and Machine Work I. Time: 10 weeks.

SECOND YEAR:

1. Airplane Construction and Repair II. Time: 10 weeks.
2. Aircraft Engine Repair II. Time: 10 weeks.
3. Aircraft Metal and Machine Shop II. Time: 20 weeks.

THIRD YEAR:

1. Aircraft Metal and Machine Shop III. Time: 20 weeks.
2. Aircraft Engine Repair III. Time: 10 weeks.
3. Aircraft Construction and Repair III. Time: 10 weeks.

FOURTH YEAR:

1. Aircraft Welding. Time: 20 weeks.
2. Aircraft Construction and Repair IV. Time: 20 weeks.

Repetitious though the course may seem, it is far from monotonous. Into its flexible schedule everything from riveting to foremanship and plant inspectorship is included, fitted in where the school program permits.

Under direction of Michael F. Steffen, Burgard's aviation course has become one of the foremost in the United States. The New York State Education Department has drafted him as aviation consultant and supervisor of the defense training schools cooperating in training men for aircraft plants.

To Steffen went the task of planning, organizing and executing the speedy establishment of many training centers. Plattsburg, Utica, Elmira, Olean, Syracuse, Glenn Falls, Niagara Falls and Yonkers have been ordered by the state to train over 2,000 workers every 10 weeks after the manner employed by Burgard. This was one of the first vocational schools in the country to co-operate with its local industry by offering aviation training in connection with national defense.

At the request of Bell and Curtiss executives in 1940, Burgard did not close its doors during the summer months. Both plants guaranteed the employment of 500 men if they could be trained by September, 1940. Dr. Robert T. Bapst, Buffalo superintendent of schools, responded by "scraping the bins" to the tune of over $17,000 remaining from the annual appropriation, with which to meet the extra costs.

Immediately swamped with 934 applicants, who stood in line for hours to register, the school picked 540 men, all high school or college graduates who were specifically trained in the short intensive courses for which Burgard has become famous. Upon completion of the 10-week course every man of the 540 was immediately hired by local aircraft plants.

News of Burgard's successful plan did a veritable "Paul Revere" throughout the nation. Cornell University dispatched a professor of engineering to analyze the plan. He found, as did a former U. S. Army colonel, several active Army officers, and several noted aircraft plant ex-

(*Continued on page* 98)

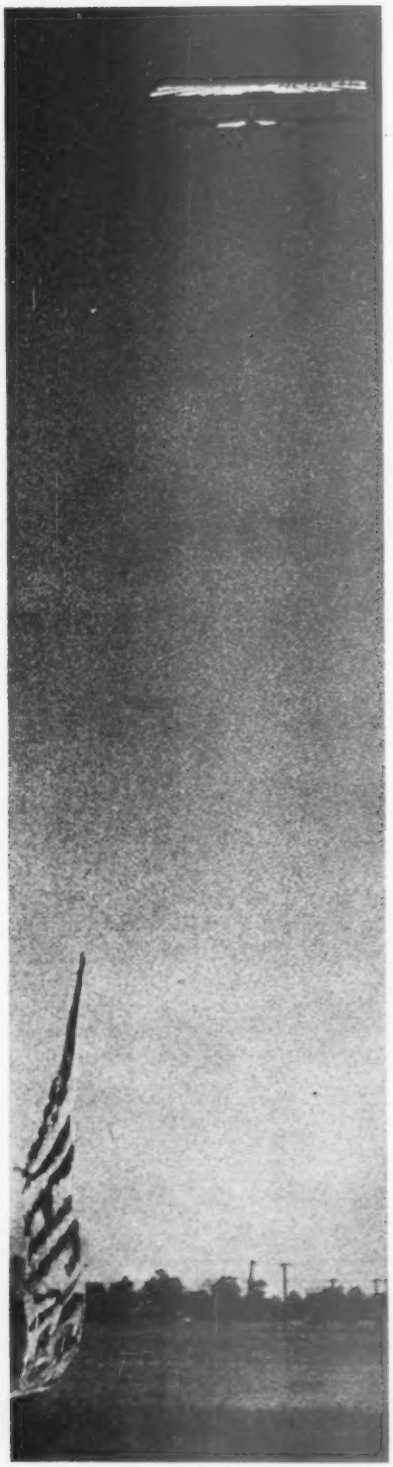
Metal workers are badly needed in aircraft plants. At Burgard, intricate machines have been installed in metalwork shops. Students use them to form metal parts.

These youths are installing Curtiss D-12 engine in old Curtiss "Falcon."

Learning to read aero blueprints isn't easy. Below an instructor explains the detailed drawings of a plane engine part.

ADS IN THE SKY

by KURT RAND



Even the air isn't free these days. Aerial banners help sell various products. Advertisers pay handsomely for sky space.

THE weather bureau says it'll be a sunny summer Sunday in Chicago on the day picked for the big American Legion parade down Michigan Avenue. That means crowds will be packed down both sides of the street. It's a natural for aerial banner advertising.

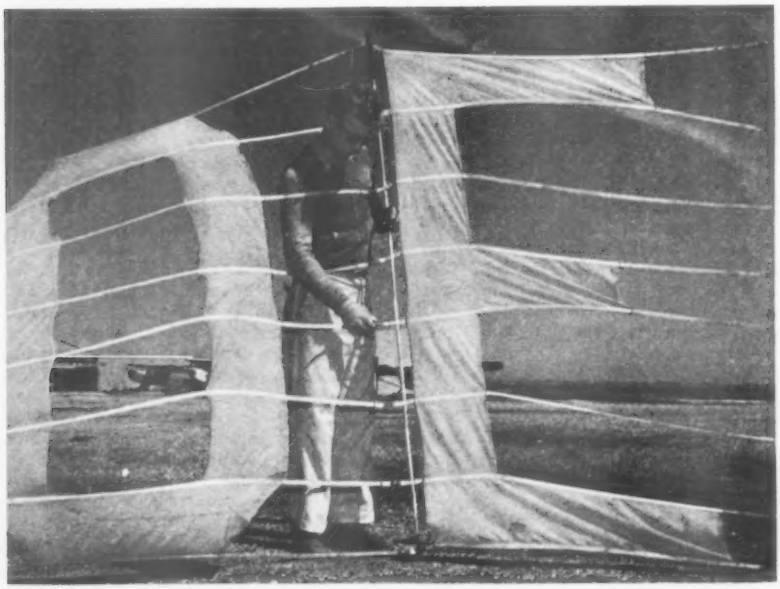
H. A. "Ham" Maurer and George Carl of Midwest Flying Service (they handle most of the aerial advertising around the Windy City) line up advertisers who each get single spot coverage of the parade crowd. That means a pilot tows a clearly visible banner, bearing an advertiser's message in 32 letters or less, over the crowd so that anyone can read it. One pilot can cover the entire parade in an hour.

With an air-minded public straining to study everything that has wings, business is good in sky banner ad circles. Smart advertisers who sell hot weather products grabbed choice contracts last summer. Makers of white shoe cleaner, beer, soft drinks, sun tan oil and swim suits hired banner flights over ball parks, beaches, zoos, carnivals and every place where summer crowds gathered.

Used intelligently, sky banners are less expensive per reader than other advertising media. In Chicago, for example, on a hot Sunday a sign may be read by approximately 500,000 people. Single coverage of the city—a flight that may take an hour or an hour and a half—costs the advertiser only $50, providing there are no special "cuts" or difficult, selective types of coverage.

Most contracts are for seasonal crowd coverage. That is, every ball game played at a local field for a season; the local beaches on every summer Sunday. This saves money and protects advertisers' ad coverage in territories where banner flights are hard to get. Coverage of one good-sized city costs around $50. The

Sky banners have letters eight feet high, linked together with bamboo poles which keep them in line. One ad can have a maximum of 32 letters. Shorter messages are best. At left, plane takes off, pulling banner; this kind of flying is difficult.



cost is less if coverage is employed regularly.

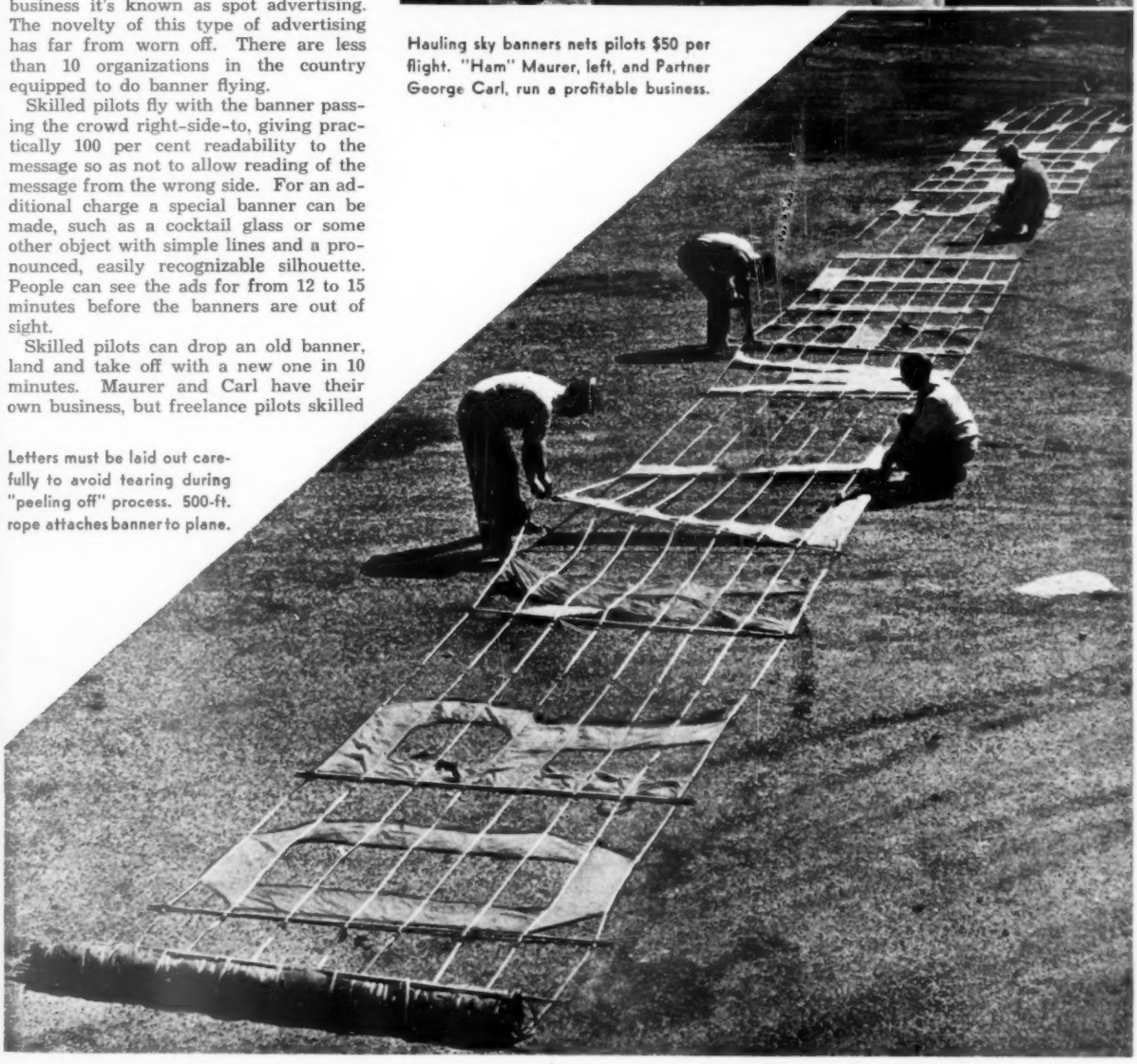
Summer is the best time for sky advertising because the largest crowds are outdoors. But it's not the only time sky banners keep cash registers ringing. The 50,000 fans at a football stadium in the fall are good customers for a fast-acting cold remedy. When election day rolls around, metropolitanites may well expect to see political advertisements in the sky. Night clubs and cocktail lounges use banner flights as funnels to entice crowds after sports events. Cigarettes, candy, dog food, household drugs—all are sold by banner advertising. Department stores also have increased sales by sending messages out over shopping crowds.

Coverage of the territory may be selected. An exclusive night club may want the race track crowd to see its banners, but it doesn't want the business of the beer-drinkers at the municipal beach. Such coverage as this (around the race track several times) is less expensive than complete coverage of the city. In the business it's known as spot advertising. The novelty of this type of advertising has far from worn off. There are less than 10 organizations in the country equipped to do banner flying.

Skilled pilots fly with the banner passing the crowd right-side-to, giving practically 100 per cent readability to the message so as not to allow reading of the message from the wrong side. For an additional charge a special banner can be made, such as a cocktail glass or some other object with simple lines and a pronounced, easily recognizable silhouette. People can see the ads for from 12 to 15 minutes before the banners are out of sight.

Skilled pilots can drop an old banner, land and take off with a new one in 10 minutes. Maurer and Carl have their own business, but freelance pilots skilled

Hauling sky banners nets pilots $50 per flight. "Ham" Maurer, left, and Partner George Carl, run a profitable business.



Letters must be laid out carefully to avoid tearing during "peeling off" process. 500-ft. rope attaches banner to plane.

When a flight is completed banners are examined for failures. Above, after inspection, letters are being rolled up for storage. Man at left winds in banner tow-rope.

in hauling sky ads are paid from $10 to $20 an hour. A competent pilot and a good businessman make a combination which should give both tidy sums when the season closes.

It's not easy money, though. Pilots doing this sort of work are constantly matching skill and nerve against such obstacles as a tail-heavy ship or a laboring engine. The banner's heavy drag affects the plane's motor as a continuous uphill climb affects an automobile motor in high gear.

Once a motor blew a cylinder during a banner job. The pilot cut his ignition, released the banner (an action instinctive to all banner-haulers) and glided down to the likeliest spot he could find.

Banner pilots must have special waivers from the Civil Aeronautics Authority for permission to tow banners. Department of Commerce restrictions limit banners to 32 letters. Pilots are thankful; less letters mean easier handling. Advertisers are protected by property and liability insurance which is carried by the flying organization which tows the banners.

The careless take-off is dangerous in banner flying. The banner must be correctly placed or it doesn't peel off the ground properly and letters get torn or pull loose. Sometimes wind tosses the letters about, spoiling the take-off and often ruining the banner.

The proper take-off occurs when the letters are laid out at a 45° angle to the midway in front of the airplane. Extending from the first letter to the rigging on the fuselage is a lead-off rope 500 to 1,000 feet in length. The plane takes off with a steep climb, letters peeling neatly off the ground.

When the plane reaches the first letter, it must be in the air. The sign then peels off the ground, running back over itself forcing the plane to fly in a nearly stalled position. Slow flight is necessary to keep the banner from whipping about. The plane flies as low as restrictions permit to give good visibility to those on the ground.

Once a banner is released, either over the field before landing or in case of trouble, the comparatively heavy lead-off pole drops first. The banner's descent is slowed by a white wind cone, four feet long, one and one-half feet in diameter, attached to the banner's tail. This acts as a parachute when the sign is dropped and serves to hold the banner out stiffly and minimize whipping while in flight.

Sharp turns and changes in elevation can play a nasty game of crack-the-whip when a banner is attached to the plane, so pilots ease their ships around gently.

Maurer and Carl hold that a flyer who intends to go into the business of banner flying on a large scale is on the right track. There are too many expenses and inconveniences in getting started and keeping up the equipment necessary for the work to make it worth the dabbler's while.

"Shoot for big contracts or not at all," they advise.

First step, they agree, is to line up clients. They service many advertisers in the midwest and have an established reputation. Business comes from personal visits to advertisers and their agencies. The pilot himself is the best salesman, for he can answer questions promptly and intelligently and has more sincere enthusiasm for his work than an ordinary salesman. His sales talk is tailored to the product, which helps.

Any plane with a high-performance engine and rugged construction can be used for banner towing. Favorite at Midwest Flying Service is a Travel Air.

(*Continued on page* 102)

DC-3 for CAA

A NEW, twin-motored, airline-type laboratory plane—a Douglas DC-3—has been added to the Civil Aeronautics Administration's fleet to aid in keeping CAA airline and personnel inspectors abreast or ahead of aviation developments. Systematic refreshing of these inspectors is essential, Administrator Donald H. Connolly explains, since they are required regularly to examine and pass on airline pilots' qualifications. In its inspection work, the plane is a flying laboratory, with accommodations for a crew of three and 12 inspectors as observers aboard, listening in on the same interphone system. Passenger comforts are eliminated to make space for test equipment. For high-altitude work, each place in the plane has an individual oxygen outlet and mask.

This is the CAA's first DC-3. Since it is typical of current airline equipment, it will be used to obtain data for regulatory purposes, to standardize test procedures and to give manufacturers and airline operators opportunity to observe and benefit by carefully engineered tests. Acceptance tests completed, the plane will be routed to the various CAA regions for the routine "flight proficiency" tests given all airline pilots. This initial tour, covering most of the country's 30,500 miles of airways will give airline operators a chance to see the ship's advanced navigating devices at their home bases. The plane will be based at the new CAA Standardization Center at Houston, Tex.

The ship's instrument equipment includes two principal radio developments. First, a general control simplification, with master radio control panel switches reduced from current transport planes' average of 18 to a total of five. Second, a dual automatic radio direction finder, developed during the past three years by CAA radio engineers and three collaborating manufacturers. It presages navigation in the entire "ocean of air" rather than in radio directional beams' relatively narrow channels.

The instrument is actually two radio direction finders interconnected, with their needles operating on the same azimuth scale. The needle of each receiver points to the station on which its receiver is tuned. Thus, when a station ahead and one to the rear are tuned in, the pilot can fly along a straight line between the stations by moving his plane to right or left until the needles form a straight line.

Fire Fighters

MEMBERS of the Lock Haven, Pa., "Cub Flyers" — Piper Aircraft employees' flying club—have aided the State Department of Forests greatly by spotting forest fires and directing smoke-eaters' work. A portable two-way radio enabled the airmen to maintain contact with the ground. The State Defense Council is considering plans to extend such lightplane use.

Lyman Gilmore, Jr., aircraft inventor, still dreams of continuing the experiments he began 50 years ago. At right, two of his planes.

PROPHET

by M. S. LORD

Before 1900, this little known aeronautical pioneer was experimenting with the monoplane, tractor propellers and retractable landing gears!

IN the fabulously rich Sierra Nevada foothills of California is something as valuable as the gold found there, yet it has gone almost unnoticed in its many years of existence. It is genius—the kind of visionary genius that made such men as Edison, Bell, Fulton and the Wright Brothers famous as contributors to the world's progress. It is the inventive ability of Lyman Gilmore, Jr., now a man of 67, who might have found a place in the sun had he been less unconcerned with personal acclaim.

While other men were trying to master flight—even while the Wrights managed to keep their crate-like biplane aloft—Gilmore was building, experimenting, meeting with a little success. He constructed monoplanes when others were working on biplanes; he tried out tractor types with the propeller in front rather than pusher types with the propeller in the rear; he designed retractable landing gears—before the turn of the century.

Drawings, dated and witnessed; photographs and the statements of men in aviation and affairs who have known of Gilmore many years verify the story of his inventions. Planes Gilmore conceived in 1898 and constructed in 1906 were basically similar to the giant transports used by airlines of today. Pioneer airmen of the west recognize him as a genius. In 1927 when the state chamber of commerce held frequent aeronautical conferences in San Francisco, the San Francisco *Chronicle* of May 6 reported:

"Lyman H. Gilmore, Jr., short of stature but long of hair and wearing a beard that never felt a razor, came unobtrusively into the aeronautical conference. Bashfully he declined to discuss himself, but pioneers crowded around, anxious to shake the hand of the man who has made such valuable contributions to aviation."

It is only natural, when the story of his activity in aviation is told, that the question is asked:

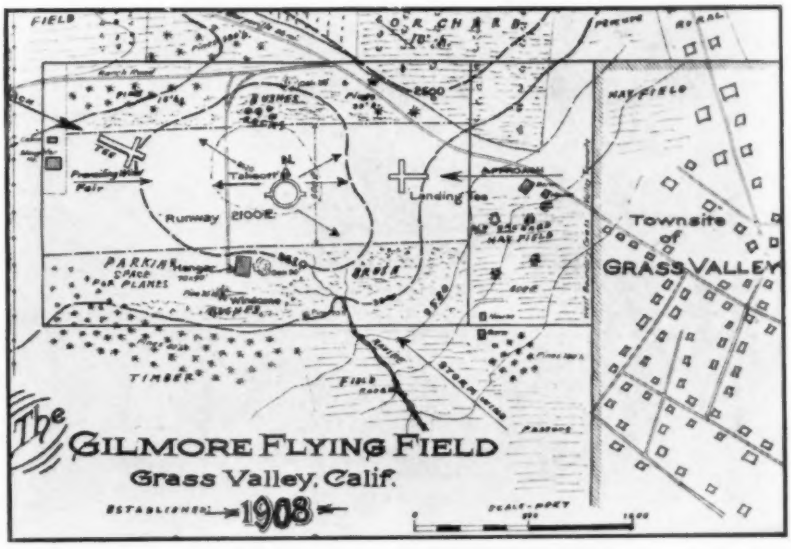
"Why has he remained unknown?"

To which William Boucher, former California Chamber of Commerce president; Harry Peterson, curator of Sutter's Fort, Sacramento; and others who know Gilmore well, reply:

"Modesty is the reason."

Born of Maine parents—Gilmore's father came to California in 1852, his mother in 1860—the boy, one of 11 children, became interested in flying in 1891. He was 17 then and constructed wings for his bicycle that reportedly kept him aloft a few seconds.

(*Continued on page* 83)



The airplane still was a curiosity at the time Gilmore laid out this flying field.

Our Warplanes are BEST

Well-proved in field service are U. S. Douglas A-20A's (foreground) and RAF "Bostons."

by Brig. Gen. GEORGE C. KENNEY

as told to DOUGLAS J. INGELLS

Criticism of U. S. military aircraft by self-styled experts is answered by one of the key airmen in the nation, who knows all the true facts.

Brig. Gen. George C. Kenney is Assistant Chief of the Army Air Corps Materiel Division at Wright Field. His job is to keep the Army's aeronautical experimental and production program functioning properly. He is in constant touch with aircraft manufacturers, knows their problems and products. Born in Nova Scotia, General Kenney was a newspaperman before he joined the Aviation Section of the Signal Corps as a private. He was one of the observers who went to France in early 1940 and brought back data that changed our warplane designs. At 52, he flies his own plane, is rated as command pilot.—Ed.

General Kenney.

WHAT'S wrong with our military airplanes? Are they killers? How fast do they land? Are there flaws in their designs? What's being done about it? How do they compare with planes of England? Russia? Germany? Are we turning out pilots with too few hours flying time? What is our plane production rate?

The average American, now footing the bill for the biggest defense program in history, has been misinformed about the answers to these vital questions. Accounts written by so-called experts have been misleading, unfair and without basic proof. The real story is one that smacks of American ingenuity and speed —automobile assembly lines transformed into plane production lines, new factories springing up in record time, planes ordered into mass production from the original preliminary drawings—and results have been encouraging.

Our air defense program is getting under way. In August we produced hundreds of military airplanes. In 1942 our production schedule should be twice that

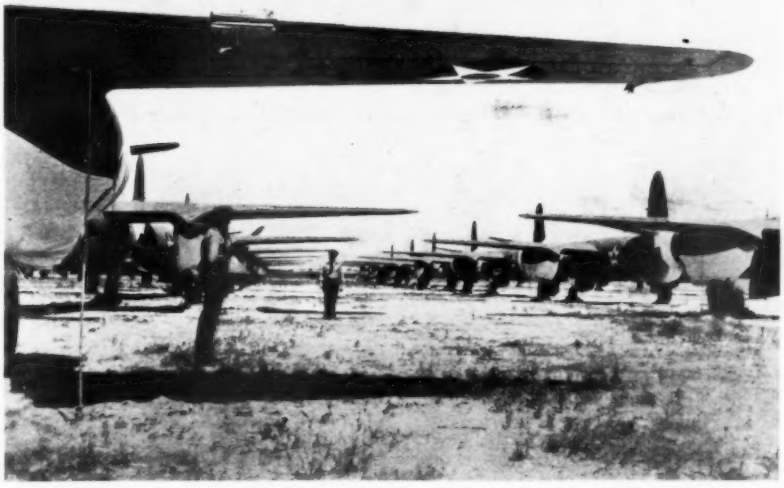
of 1941. Some of our planes have been going to the British, some to China, South America and Russia, in addition to our own Air Forces tactical units. Likewise, pilots—thousands of them—are being turned out at our big air training centers. These lads are proving themselves capable of flying every type of plane we are now producing. With only 300 or 400 hours of actual flying time, they climb into our fastest bombers and pursuits and handle them like veterans. This talk about pilots not liking to fly the new planes because the ships are "touchy" is just talk. The youngsters have already shown us that they can handle airplanes hotter than anything we have yet produced.

The planes we are getting are the best in the world. They fly higher, farther, faster, carry more bombs, have better armor and heavier caliber guns than any other ships. We're proving this every day with extensive accelerated tests being run at the Materiel Division, and changes are being made right in the production lines when we find something wrong.

There *are* some dangers in military flying. The military airplane is built to fly fast, to take a rugged beating. It is built as an implement of war, like a tank or battleship. You can't expect our bombers to be airliners, our fighting planes to be sport planes. We have to install armor to protect the pilot, plenty of guns, the most powerful engines that can be obtained—and we have to do more and more of this while some of the ships are still on the assembly lines.

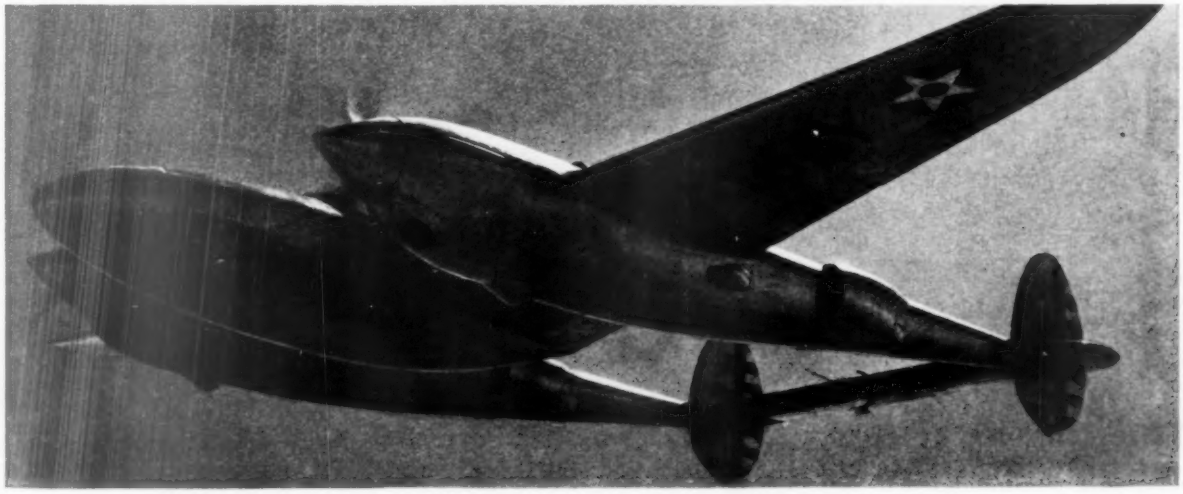
Take for example, the new Martin B-26 bomber. This plane has been labeled a dangerous killer. The story of the B-26 is something new to all of us—a splendid example indicative of progress made in American aeronautical engineering. The Martin came into being early in 1939. It was shown to War Department officials while it was still in the stages of draftsmanship and they ordered it built. Actually it was a "paper airplane." For the first time a military airplane was put into production without first going through a two or three year design-to-

American-built heavy bombers like this B-24 for RAF have no equals in foreign ships.



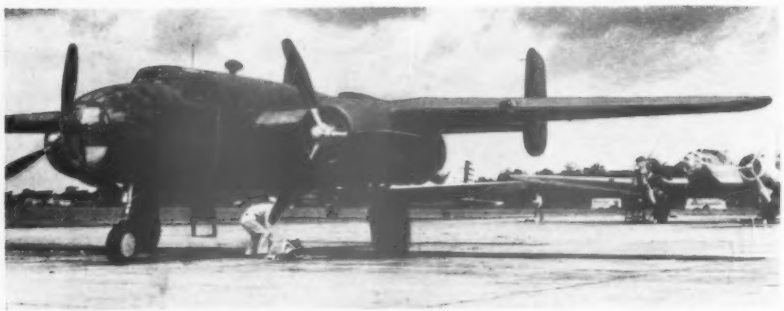
These B-26's are idle at their factory field because of temporary propeller bottleneck.

The P-38 is said to be one of two ships in the world capable of speeds in excess of 400 m.p.h.



British Boeing B-17's in actual combat are outclimbing Nazi fighters above 32,000 ft.

Heavy tread tires, brakes and tricycle gear permit B-26 to land safely at 110 m.p.h.



A tricky nose wheel lock, now remedied, brought about criticism of North American B-25.

Workers install leak-proof tanks in an A-20A. More guns and armor also were added.

product period. There were changes incorporated in the ship before the first model came off the assembly line in the summer of 1939. These changes were the result of the war abroad.

At that time U. S. military observers in Europe learned from the French that the Germans were contemplating using a 13 mm. gun (equivalent to our latest .50 caliber gun) in their fighting planes which would be highly effective against the one-quarter inch armor then in use on most Allied planes built abroad and in this country. The same armor was being installed on our new planes. As a result of the reports, armor plating on the B-26 and other planes was increased in thickness and the .30 caliber guns being used were replaced by heavier .50 caliber. This added more weight than on original models, naturally increased such factors as length of take-off run and landing speed. But the tricycle landing gear was then becoming standard on our planes, and this gear was designed specifically to allow for faster landings in anticipation of constantly increasing weights. It also proved the solution to a pilot's biggest worry—keeping his plane in a straight line when landing and eliminating ground looping.

The first B-26's produced a bigger problem in their take-off characteristics than in their landing capabilities. It was necessary to clean up the landing gear considerably before we could shorten the take-off run to a desired distance. The additional weight increased the landing run a little with the result that pilots had to sit in the ships a few seconds more while they rolled to a stop. Some of the lads flying these types in accelerated tests put them on the ground at about 100 to 115 m.p.h. and take their hands off the controls, letting the ships guide themselves.

It is unnecessary to land these planes at such speeds (110 to 115 m.p.h.), but pilots generally prefer to put the wheels on the ground at 10 to 15 m.p.h. above actual stalling speed or landing speed. The Martin B-26 can be landed as low as 90 m.p.h., which is not considered high with the modern tricycle undercarriage and brakes. This higher landing speed gives the pilot a reserve that enables him to have better control of his plane in the event that some obstacle presents itself in the landing path, necessitating another approach. We've put special heavy-tread tires on the ships, which help cut the required landing distance by making possible greater use of the brakes. Landing speeds of 100 m.p.h. are commonplace on both our bombers and pursuits. There is nothing dangerous about this speed; we are doing it every day. It should be noted that the tricycle landing gear is an American innovation not found on any foreign-built aircraft.

Recently three Patterson Field pilots, all lieutenants who were brought in from various squadron units, were sent to Martin's Baltimore plant to bring back three of the latest B-26's for accelerated tests. Returning, they ran into a series of thunder squalls so severe that soon after their

(*Continued on page* 68)

Worker uses special tool to press fastener strips. The idea is used on flat surfaces, but it will work on curves like one below.

New Fabric-Attachment Method

by COURTNEY RANDALL

A unique but simple method of attaching fabric is speeding production at Bell Aircraft.

"WHY didn't someone think of that before?" is the typical reaction of aircraft production men when they are shown the method developed by Bell Aircraft Corporation engineers to attach fabric to the control surfaces of its fighter aircraft. Simple as it is, the fabric attachment method might never have been perfected if the company had not been faced with the necessity of adopting new and better manufacturing techniques in order to turn out the hundreds of cannon-carrying fighters on order by the U.S. Army Air Forces and the Royal Air Force.

A year and a half ago, Bell and every other airplane company which had received substantial orders—was faced with a two-fold problem: (1) to increase its working force tenfold, and train it, and (2) to devise manufacturing methods which could be used efficiently and speedily by the semi-skilled labor available. In the first instance, Bell enlarged its payroll from less than 1,500 employes in the spring of 1940 to 11,000 on November 1, 1941. Besides hiring these workers, the company trained them to do the special types of work which are unique to the aircraft industry.

With respect to problem No. 2, the company developed more than a few new tools and techniques—among them the fabric attachment method—and reworked about 30 per cent of its original *Airacobra* design so that 100 per cent lofting could be adopted. The 100 per cent lofting means cutting steel templates of every one of the 9,000 plane parts—just as the tailor prepares his paper patterns for suits and dresses—so that blueprints would not be needed during assembly or fabrication operations. Even rivet holes on parts which later were to be shaped into complex forms by giant hydraulic presses were pre-drilled by the lofting method.

The fabric attachment method is a typical development. It originally was suggested by the company management. In fact, the fundamental advantages to be obtained from the method finally devised were specified in the assignment. The resulting work had to be simpler, stronger, more economical and quicker. Other advantages—which included neater, more attractive work—were incidental.

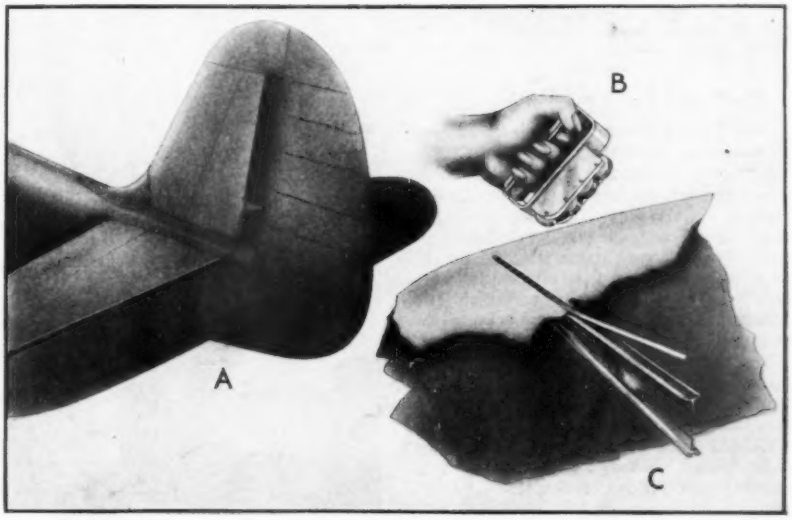
Conventional procedure was to stitch the fabric to the ribs of the control surfaces of aircraft, then to mask the stitching with strips of balloon tape. Considerable hand work was involved and, in face of the national emergency when 50,000 planes was the order of the day, the cost in time of such methods was of vital importance.

The new fabric attachment equipment includes a special rib—easy to manufacture—a thin retainer strip and a hand tool for pressing the retainer strip into the rib. The ribs differ from the conventional rib principally in that they include a channel in the horizontal member of their "T" shape. They are extrusions of 24ST aluminum alloy. The thin retainer strip is of 2SO aluminum drawn to an approximate semi-circular cross-section, the width being held to within .005. Corners are clipped and burrs are removed. The hand tool, containing several different types of rollers—the first to spread the strip and the others to flatten it—is employed to insert the strip in the channel and hold the fabric firmly in position throughout the operation.

Now standard production practice in the building of the *Airacobra*, the method was given thorough testing under the supervision of the Air Corps. A panel was built in the usual manner, but with wood in front and on the sides, a standard trailing edge and the standard ribs. It contained three bays, with the width between the ribs corresponding to that of the elevator design.

An inlet was provided through which

Bell uses process on P-39's fabric-covered tail surfaces (A). Hand tool (B) is grooved to fit specially designed rib (C), pressing fastener, fabric and rib together.



air was pumped inside the dope-covered fabric and an outlet was connected to a manometer upon which the pressure, in inches of mercury, was read. If the new method of attaching the fabric were unsound, the pressure, from the inside out, would have blown the retainer out of place. Besides, it was calculated, this method of testing was more severe than the same amount of pressure from the outside, in actual usage.

Various pressure loadings were obtained, by regulation of the amount of air pressure built up within the test section and, after each test, the pressure was returned to zero, then built up again to the reading desired. When failure finally occurred, it was not the fabric attachment but a rivet, tying two ribs together, which gave way. Consequently, the load dropped off as the fabric ballooned out without restraint. When the rolled strip was removed, no signs of strain could be found on the fabric throughout the attachment area. Comparative tests showed this method of attachment to be stronger than either the stitching or sheet metal screw processes.

The Bell Company uses the method only on its control surfaces, but experimentation has shown that it may readily be used on rounded sections (see photograph). The minimum diameter that the extrusion can be rolled constitutes the only limitation and wide application of the process is believed to be likely in the manufacture of lightplanes, of the type which use fabric for fuselage and wing coverings.

END

Licenses

IN a special bulletin to FLYING AND POPULAR AVIATION, the Civil Aeronautics Administration has released the following monthly statistics:

	Oct. 1 1941	Oct. 1 1940
Pilot certificates of competency	91,442	44,000
Airline transport certificates of competency	1,554	1,299
Student pilot certificates	93,177	52,983
Glider pilot certificates of competency	158	132
Student glider pilot certificates	553	445
Mechanic certificates of competency	13,259	10,569
Parachute rigger certificates of competency	641	435
Certificated aircraft	23,496	15,200
Uncertificated aircraft	447	519
Certificated gliders	59	35
Uncertificated gliders	109	102
Ground instructors certificates of competency	4,287	1,277
Air-traffic control-tower operators certificates of competency	386	236
Air carrier dispatchers certificates of competency	432	307

New Aircraft Radio

A NEW lightplane radio receiver, weighing only nine pounds complete with heavy duty batteries, battery case, cables and headphones, has been put on the market by Harvey-Wells Communications, Inc., Southbridge, Mass. Incorporating the latest aircraft radio engineering advances, the four-tube unit measures only 6 inches wide by 4¾ inches high by 4 inches deep. Batteries are mounted externally in a special case.

The receiver's tuning range is continuously variable from 198 to 405 kc. The superheterodyne circuit employs a stage of r.f. amplification. Designated as the AR-2-A, the unit has been thoroughly flight-tested. It may be mounted in any number of positions on the ship.

FROM HEADQUARTERS

by Lieut. Col. HAROLD E. HARTNEY (A. F. Res.)

AVIATION skeptics—vintage of 1923—surely must be blushing these days. They "pooh-poohed" the idea of the interdependence of nations and the employment of aviation generally in a world conflict. No wonder they blush now when they see 2,500 young lusty British cadets training here south of our Mason Dixon line or when they observe huge Clippers based in our harbors—large ocean air transports that fly on long three-week sorties over the war-torn European areas, returning for their overhaul and rest in American ports. What do the skeptics say now? What will they do?

Newspapermen are entering the Army and flyers are leaving it. This correspondent was on duty with the Ferrying Command until some bright sergeant in the sanitary corps—nothing to do with aviation—spotted him walking around with a limp obtained several years back in a crash of the fastest airplane then in existence. The sergeant wrote up a report and "yours truly" had to duck—temporarily. As I walked out, I saw Capt. Joseph S. Edgerton, Ray Cooper and some other "crack" aviation newspapermen coming in as commissioned specialists. Ironical as it seems, this old bird was going out to try and write a column.

The specialists reserve corps in the Air Forces has enabled the War Department to get some good men. There are others whose age has barred them to the prejudice of the service but very shortly, due to new provisions, they too will have a chance. Write the adjutant general for particulars if you are interested.

There are many Quiet Birdmen in Washington these days. Some have commissions with our own services and others are with the British Air Commission. The Navy appears to recognize experience in aviation better than does the Army. Rear Adm. John H. Towers has Jimmy Taylor, Luis de Florez, Haven Page and other experienced aviation notables to man surface vessel-borne aircraft. Like members of the American Legion, the old timers in the QB's take life more seriously as they shoulder new responsibilities.

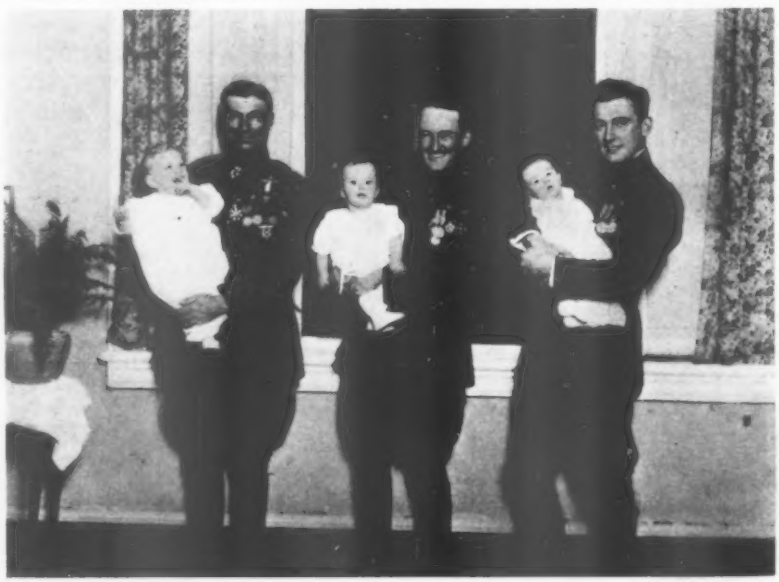
They say Harry Bruno is here. With the late Dick Blythe and the Ladislas D'Orcy, he organized the QB's. But "Jackie" Cochran and Floyd Odlum, busy expediting sub-contracting in defense for OPM, keep him so busy that he has to date failed his brother QB satellites. Maj. Ernest Jones, secretary through thick and thin of the Early Birds, reminds one of the old fire horse. When the fire bells began to ring, he came running back to his old harness in the office of the Chief of Air Corps information beside his old side-kick Falk Harmel.

Col. R. A. Dunn and Col. H. S. Burwell both are back home from an extended tour in the war zones. Catching up with them is difficult for their reports are to be voluminous and about the most important documents in the secret files. Nothing is more valuable these days as first-hand "proving ground" reports made by officers with the aviation experience and ability of these two gentlemen.

Gen. "Mike" Scanlon with his able executive Marion Cooper is head of A-2 (Air Forces Intelligence) of the Army Air Forces. Brig. Gen. Carl Spaatz, a brilliant World War pilot ably assisted by experienced pilots, Maj. E. P. Curtis, DSC, acting as secretary (95th Squadron

(*Continued on page* 102)

From left to right, these baby contest judges (date: the early '20s) were famed Billy Mitchell, Lieutenant Colonel Hartney and Capt. Burdette Wright, now Curtiss-Wright head.



LAPSED LICENSE

Instructor John Franks gives the author, left, some new tips. Ship is a Luscombe.

by LEWIN B. BARRINGER

Here's a warning to pilots not to get behind in their flying. A refresher course is tough.

Though still a young man, Lew Barringer is one of the country's best-known veteran pilots. An accomplished powerplane pilot with nearly 2,000 hours to his credit, Barringer also made a name for himself as a sailplane pilot; he has written articles for this magazine on gliding and is the author of a book on the subject. He recently became head of the Army's new glider training program, now is in Washington.—Ed.

LAST summer I found myself, for the first time since learning to fly 12 years ago, not actively employed in aviation. My new position kept me too busy to get in sufficient time to feel thoroughly comfortable at the controls.

Through necessity, I let my commercial pilot's license lapse. The expiration date was September and three months later I regretted my decision. Now I am glad of it. Fate played what then seemed a dirty trick. A sinus infection necessitated my leaving the New Jersey flats and living in a drier and warmer climate. I left in January for Southern California where I met Leland Hayward, Hollywood agent, TWA director and owner of a five-place Howard. He offered me a job with Southwest Airways, Inc., his company.

The first thing necessary to get back into aviation was to get my license back. I applied to the Santa Monica office of the CAA for a commercial refresher course. The senior inspector in charge was my old friend, L. R. Scroggie, whom I knew in Pittsburgh. He introduced me to Earl Myers, who assigned me to Southwest Airways' CPTP school at Sky Harbor, Phoenix, Ariz.

Arriving there in February, I noticed many changes had occurred since I landed there nine years before with the first wire-braced Waco cabin airplane. Storage space in the old Scenic Airways hangar had been doubled by addition of another large hangar adjoining. Another new building housed the offices for American Airlines, TWA, the CAA weather station and the Arizona Inspection Service. Southwest Airways was located at the north end of the new hangar in a small office building with a porch and awning.

I met Jack Connely, vice president and general manager and former west coast CAA flight test expert, and John Swope, secretary-treasurer for Southwest. The growth of this company is interesting: Starting operations in October, 1940, with a small CPTP program at Sky Harbor, the company at first operated nine airplanes and employed six pilots and two mechanics. Six months later it was operating 46 airplanes with 35 pilots and 55

(*Continued on page* 88)

Airport Dollars and Sense

by A. W. BERNSOHN

An airport is a business establishment that operators must handle accordingly

Charges for everything from parking to sightseeing first appeared at LaGuardia Field, N. Y.

TABLE I
LANDING FEES

City	Terminal Class	Population Class	Approximate Annual Income from Source (1939)	Description of Rates, etc.
Knoxville, Tenn.	IV	B	$1,861	Flat charge made to American Airlines for use of field, office space, and all facilities.
San Diego, Cal.	III	B	300	Charge based on $25 per month—one landing per day—to transport companies owning no hangars. Those owning hangars pay ground rentals in lieu of landing fees.
Charlotte, N. C.	III	C	600	No landing charges made to those other than scheduled operator—Eastern Air Lines. Income result of 5 yr. (non-exclusive) contract with operator, and includes office space.
Augusta, Me.	III	E	780	From Northeast Airlines. Includes office rental as well as landing privileges.
Elkins, W. Va.	IB	E	180	Contract with scheduled air carrier giving airline free use of field and office space.
Harrisburg, Pa.	II	C	200	Contact with scheduled air carrier gave this sum and included office space.
Memphis, Tenn.	III	B	No figure for 1939	Each of three airlines pays landing fee of $125 per month for first round trip schedule, and $25 per month each additional round trip thereafter. All landing fees waived if as much as 10,000 gallons of gas are purchased at the field.
Nashville, Tenn.	II	B	No figure for 1939	Two airlines pay no landing fees as such, but both pay "airport rent" which includes landing privileges. American pays $500 per month for use of airport, Eastern pays $200 per month
Barre-Montpelier, Vt.			600	Boston & Maine pays $50 per month landing privileges and office rental—office 10′ x 18′.
New York City	I	A		Landing fee is based on weight of plane, as follows: *Weight of Plane* — *Fee* Under 4,000 pounds . . . . $ 5 4,000- 6,000 pounds . . . 7.50 6,000- 9,000 pounds . . . 12.50 9,000-15,000 pounds . . . 15 15,000-50,000 pounds . . . 15 plus $2.50 for each 5,000 pounds in excess of 15,000. 50,000-100,000 pounds . . . $15 plus $2.50 for each 10,000 pounds in excess of 50,000.
Hyannis, Mass.				$1 per landing.
Billings, Mont.			990	No landing fees charged to Inland Airlines, Northwest Airlines pays $65 per month for Trip 1 and $3.50 per month extra for each of Flights 2-6.

CITIES have been footing municipal airport bills for a good many years. But lately they're shouting that aviation's getting to be a big boy now; it should soon be able to pay its own check.

Questionnaires are sent out. Surveys are made. Mayors besiege the Civil Aeronautics Administration to help make airport administration more uniform. Airport expenses and revenues are compiled and compared. Local government officials wonder why comparable airports take in such widely varying purses. Furthermore, they're wondering how they can step up the intake from their airports.

It's just begun. The first reports are now appearing. They're incomplete, but they're pretty accurate windsocks. They show that:

(a) Some sportsman pilots may soon have to dig deeper into their jeans for more folding money and change. Larger airports may have to step up hangar and storage fees to pay for the new hangars they'll have to build. Smaller ones may charge more or higher landing fees.

(b) Federal Governmental agencies and others who've been getting a free ride on the rent bill may soon be asked to shell out by more airport managers.

(c) Greater emphasis will probably be placed on concessions at the ports that have neglected them in the past. The concession's cash registers are being eyed

enviously by more than one city administration.

(d) More state taxes on aviation gasoline may be expected in states that have neglected to pass the hat at filling stations and (better news) states that have been using aviation gas tax funds to feed the general kitty will be bombarded with requests to start defraying more airport expenses.

(e) Efforts will be made by city officials to start paying less to keep airports running smoothly. Auditors and efficiency experts are getting set to ride forth in mortal combat with inefficiency.

All this belt-taking-in has a reason: —About 85 per cent of the 600-odd municipal airports in this country wind up their fiscal years every year in the red.

So says the astute American Municipal Association, counsel and guide to harassed city governments throughout the country. The association has recently published a series of detailed reports on municipal airport problems. This revealed much about airports that had never before been made public.

With the majority of airports putting the bee on city treasuries every year, with aviation and airports well out of the experimental stage, with everyone yelping for lower taxes and with scads of new treasury-tappers offering the city budgeteers a hand, palm upward, those budgeteers are training their bifocals on every possible source of lowered expense or increased revenue they can find. Airports are in the line-up.

Now the cities aren't going to wreck the aviation they so carefully nurtured during the growing-up stage by loading it with increased expense. They're even willing to write off the earlier years of airport costs from their books as their contribution to aviation. But they're getting set to do their darnedest to make the airports break even. They're not going to overcharge—if they follow the advice their central organization has compiled at their request—but they're studying those rates preparatory to making some changes in them.

Why? Well, the WPA and the CAA have millions of dollars to spend on fixing up airports. We have only three dozen places in the country that are recognized as suitable for all kinds of military aviation requirements—and even these aren't strategically distributed. These millions available are to build or improve the airports but it's up to the cities to pay for the running and keeping-up of the airports. The municipalities don't want to bite off too much; they want just all they can safely handle.

Then defense enters into the picture, too. This is forcing tremendously rapid growth in aviation. Mass production plummets plane costs so more people can afford to fly. Mass training makes more of us flying minded so more people are able to fly. After the present emergency is over, aviation will be bigger than ever before. Cities want to handle this full-fledged business in a sound, business-like way.

Their big money-bringers are landing fees, rents, hangar and storage fees and income from fueling and servicing planes.

TABLE II

HANGAR AND STORAGE FEES

City	Terminal Class	Population Class	Approximate Annual Income from Source (1939)	Description of Rates, etc.
Knoxville, Tenn.	IV	B	$2,542.22	*Monthly rate:* Single Engine Wing spread under 40 ft. $10 Wing spread 40-50 ft. 15 Wing spread 50-60 ft. 20 Wing spread 60-75 ft. 25 Wing spread over 75 ft. 30 *Monthly rate:* Multi-Engine Wing spread under 40 ft. $15 Wing spread 40-50 ft. 30 Wing spread 50-60 ft. 40 Wing spread 60-75 ft. 50 etc.
Charlotte, N. C.	III	C		*Cub* airplane class: Per day $ 1 Per month 10 Fairchild class: Per day $ 1.50 Per month 12.50 Stinson *Reliant* class: Per day $ 2 Per month 15
Augusta, Me.	III	E	358	$7-10 per month hangar rental charge.
Little Rock, Ark.	IV	C	2,400	Monthly rates: 50 h.p. 2 place $12.50 3-5 place 15 6-10 place 15 Nightly rates: 50 h.p. 2 place $1 3-5 place 1.50 6-10 place 2 There is a tie-down charge of $1 per night if there is no hangar space.
Houston, Tex.	III	C		*Cubs*, Aeroncas, Taylorcrafts $22.50 mo. Wacos, Beechcrafts, Fairchild "24" 25 mo. Stinson, Howards, Spartan, Fairchild "45" 30 mo. Northrops and Lockheeds 42.50 mo. $1.50-$7.50 per night on various transient ships.
St. Petersburg, Fla.	IV	D		Lightplanes $10 mo. Heavy planes 50 mo.
Elkins, W. Va.	IV	E	292	Monthly: Small plane $ 5 Larger plane 10 Nightly: Small plane $1 Large plane 1.50
Harrisburg, Pa.	II	C	1,500	Monthly: Small plane $ 7 Large plane 15 Nightly: Small plane $1 Large plane 1.50
Memphis, Tenn.	III	B		Monthly: (Operated by FBO—fixed base operator) Small plane $10 Large plane 50 Fixed base operator pays rental to city of: Old hangar—8c per sq. ft. per year. New hangar—21c per sq. ft. per year.
Nashville, Tenn.	II	B		One fixed base operator rents hangar at: $100 per month. Two fixed base operators pay: $10-$20 per month per plane for hangar storage with any transient rentals collected accruing to them.
Barre-Montpelier, Vt.				Only operator on field pays flat rate of $1,500 per year for complete use of hangar, landing area and gas and oil concession. Pays no additional percentages.
Utica, N. Y.				$10 per month to fixed base and private operators.
Moline, Ill.				$7.50 minimum, $10 maximum per month (depending on size of plane) in cold hangar, $12 and $15 respectively, in heated hangar.
Peoria, Ill.				$10-$15 per month for light planes. Itinerant storage, $1-$2 per night.
Billings, Mont.				Monthly rate: $15. Nightly rate: $1 to $5. $1 for *Cubs* or planes of that class. $1.50-$2 for Stinsons or that class. $5 for Lockheeds or planes of that class.

Generally, the smaller the airports the smaller the percentage of their income from landing fees. The ports at which 1,200 or more landings are made a month receive more than two-fifths of their income from landing fees. The smaller terminal ports, at which just a couple of hundred planes land a month, get but three per cent of their income from this source! In contrast, the latter size port draws more than a third of its income from hangar and storage space while the former gets less than a fifth of its returns from these fees.

The larger airports, like New York's LaGuardia Field, have other sources of revenue. Parking space costs 25 cents per car and 10 cents per head is charged for persons who go up onto the flight deck of the administration building to see planes land and take-off. Bus and taxi companies pay the city a percentage of their income from airport visitors and airline passengers. Landings cost the private plane owner anywhere from $2.50 to $50, depending upon the gross weight of his plane. Storage charges go into effect if his plane is left on the grounds for eight hours or more.

At LaGuardia Field and other large air terminals, restaurants and bars also help to swell the city's income. In most cases these concessions are operated by the airlines who have to pay part of their "takes" to the city. Income from a restaurant operated on a lease basis by one

TABLE III

INCOME FROM SALE OF GAS AND OIL

City	Terminal Class	Population Class	Approximate Annual Income	Description of Rates, etc.
Knoxville, Tenn.	IV	C	$2,914	City receives $0.01 per gal. for each gal. of gas sold by the Standard Co. at their station on the field. This nets approximately $465 of the total figure. The balance results from the state refund of 3½c per gal. to the airport from a 7c state gas tax.
San Diego, Cal.	III	B	1,244.07	Oil and gas concession on field give to the airport income of 1c per gal. on gas, 5c per gal. on oil, ¼c per lb. on grease.
Charlotte, N. C.	III	C		Contract with airline gives city right to dispense gas from the airline tender at 1c per gallon profit to city. City has government fuel contract for fueling Army, Navy and Marine aircraft that usually amounts to 75,000 gallons per year.
Little Rock, Ark.	IV	C	8,595	Arkansas has no gas tax and the airport pays 12c per gal. for gas which sells for 25c. This 13c per gal. profit was made on 36,500 gals. In addition, the airport has a contract which pays 1½c per gal. for each gal. of gas which it services for American Airlines. This gas is owned by American and the charge is purely a service expense. The contract establishes a $237.50 per month minimum for the service.
Houston, Tex.	III	B		$0.01 per gal.
Memphis, Tenn.	III	B	14,400	Standard Oil pays $200 per mo. for exclusive gas privilege. In addition, the state refunds 3½c of a 7c per gal. state tax gas to airport—amounts to approximately $12,000.
Nashville, Tenn.	II	B	25,000	Income from the 3½c refund on 7c per gal. state gas tax.
New York City (Floyd Bennett Field)				City sells no gasoline directly. Collects royalty of 5c per gal. on oil and 2c per gal. on gasoline sold by operators.
Billings, Mont.			75	Gas concessions held by airport manager, only vendor on field (schedule carriers have own gas). City receives $75 per year from airport manager for rental of tanks.

TABLE IV

INCOME FROM CONCESSIONS AND MISCELLANEOUS SOURCES

City	Terminal Group	Population Group	Annual Income	Description of Sources, etc.
Minneapolis, Minn.	II	B	$4,154.79	Net income from city-operated refrectory.
			2,035	Gross income from hotel and dormitory in administration building operated by city and maintenance charged to administration—there are nine bedrooms and two dormitories of six beds each. Rates: *Hotel* Regular monthly rate—double $25 Regular monthly rate—single 20 Regular daily rate—double 2.50 Regular daily rate—single 1.50 (Special rates to airline passengers.) *Dormitory* Regular monthly rate $10 Regular daily rate 1 Regular weekly rate 6
			1,327	Gross income from rental of 45 garages—Maintenance only—$29 *Rates:* Monthly $3.50 Daily (24 hrs.) .50
Madison, Wis.	IV	C	500	Airport land leased to local farmer for cultivation. Figure represents rental for this land.
Lancaster, Pa.	IV	C	71.66	Received from refreshment concessions in the form of percentage of sales.
Roanoke, Va.	IV	C	107	Rental of city-owned lockers.
Little Rock, Ark.	IV	C	300	Rent paid to the airport by privately operated restaurant.
			1,000	Hay cut from 200 acres of landing area by city mower—this gave approximately 6,000 bales of hay which ran about 30 bales to the ton or 200 tons. Marke. value of 200 tons being $1,000.
Charlotte, N. C.	III	C	1,200	Restaurant concession pays: 1st yr., 10 per cent of gross take 2nd yr., 12½ per cent of gross take. 3rd. yr., 15 per cent of gross take. City receives 10 per cent of gross of barnstormers. Plane washing service—Charges range from $1.25 to $3 (more information requested).
St. Petersburg, Fla.	IV	D		Non-resident operators pay 10 per cent of gross income to city.
Memphis, Tenn.	III	B	900	Restaurant concession pays $75 per month for operating nights and rental for space. Western Union and Southern Bell Tel. and Tel. pay 10 per cent of gross sales for rental and operating rights.
Nashville, Tenn.	II	B	1,200	Restaurant concession pays $100 per month for operating privilege and rental.
New York City (Floyd Bennett Field)	I	A	$2,110.15 (representing 10 per cent of the gross revenue from passenger flight revenues)	Passenger Flight.
			56.25	Weighing Machine.
			$2,921.62 (representing 5 per cent of gross in 1939)	Restaurant.
Utica, N. Y.			350	Restaurant.
Billings, Mont.			$600	Restaurant concession for which city receives $50 per month. Restaurant concession headed by airport manager's wife. All air shows are held under the auspices of Air Shows, Inc., a non-profit organization. The city receives no income from shows or concessions pertaining thereto.
Chicago, Ill.			Minimum guarantee of $30. $30,004 covering a 4-year period, plus 10½ per cent of the gross receipts of each year over and above $70,000.	Chicago City Council, on April 3, 1940, authorized acceptance of a contract for the exclusive right to operate sight-seeing airplanes for hire at the Chicago airport. Two other unsuccessful bidders offered to pay the city $12,500 and $16,416, respectively.

of the airlines was enough to pay hangar rent for a year. Newsstands, cigar stores and other concessions are also sources of income.

Some smaller fields such as the ones at Lima and Dayton, O., have written off some upkeep expenses by holding each year an air show with half the proceeds going to the city for airport expenses. At Dayton's municipal airport the Army has long paid the city for use of the field's runways for conducting brake tests on its big bombers.

It's the lower middle size terminal airport that makes the most from fuel and oil. More than a third of its profit is from this source while the mammoth ports obtain little more than a tenth of their revenue from their pumps and oil cans. Upper middle size ports find rents to be their most remunerative angle. Nearly three-tenths of their ledgers' credit-columns arise from rentals. This is probably the most uniform of the sources of airport income. The largest airports get a little less than a fifth of their financial returns from rents and the smaller ones get a little more than a fifth from this source.

Minor incomes are derived from commissions, utility services, and other sources. The large airports are earning about a sixth of their proceeds from concessions while the others get only between two and four per cent on the average from that source.

These various groups and individuals are peeking over each other's shoulders at business returns of this sort and then checking their own ledgers. The concessions furnish an interesting clue to the revenues to be expected from sources other than aviation directly. Auto parking, admission charges, profitable restaurants and refreshment stands, sleeping rooms, converting unused land to other purposes, garages, lockers, washing of planes, or concessions such as the exclusive operation of sight-seeing planes—all of these not strictly aviation sources of income are utilized in some places (and many will soon be copied by more) to lighten the burden of paying for airport operation and maintenance.

Further efforts to keep the burdens proportionately divided among the aviation enthusiasts and to lighten the load of keeping up the municipal airports lie in aviation gasoline taxes. Their reports have informed the city administrations that only 20 states collect a tax on aviation gasoline without refunding it and nine of these do not use such tax funds to further the cause of aviation; only eight use them for airport purposes. The city officials aren't inclined to accept a situation of this sort supinely. They're tapping state legislators on the shoulders and reminding them about how useful their city's support can be—come next election time. They did it most successfully on auto gas taxes.

Other sources of income, taking representative municipal airports as barometers of those throughout the country, may be approximated with the aid of the accompanying charts from Report No. 143 of the American Municipal Association.

But the municipalities aren't content to check figures without taking positive

action. They discovered that a report of the Federal Coordinator of Transportation found scheduled air carriers to be carrying less than their share and they put them on their list.

The report of the coordinator found the proportion of annual cost of publicly-owned airports assignable to scheduled air carriers to be 36 per cent of total costs, or $15,365,070 for 1935-38. They paid $2,200,319 during that period. These figures aren't really complete and, therefore, we can't vouch for their accuracy. But they've been circulated among the city administrations and the air port owners may soon raise the ante.

They won't try to skyrocket the prices, but they've found many of the companies to be operating sufficiently in the black to make more generous contracts for forthcoming years. The real annoyance seems to be the variety of prices the airlines are paying with each contract being negotiated separately. The cities which own airports want more standardization, the municipal association reports.

The ports are rather proud of the fact that no appreciable charges have come through that they're stifling air travel with high prices. They'll try to keep that reputation, their association prays. But they're keeping an eye on the amount of free service they'll have to give army and navy planes in the near future.

The example of the British handling of this problem may be emulated by the United States. There, the Aerodrome Owners Association and the Air Ministry worked out a satisfactory standard airport charge schedule together. It curtails (or curtailed) both sloppy handling of business matters concerning the airport and unreasonably high charges.

Expenditures made by the various airports are nearly uniform in comparison with the incomes they receive. Salaries hover around 53 per cent of the total income, utility services and heat take about eight per cent, upkeep of field areas and miscellaneous sources each take about seven per cent, field lighting takes about six per cent, hangars and maintenance of runways each take five per cent, field rents four per cent, insurance is three per cent and traffic control and taxes tap the treasury for one per cent each. This is an average, and most ports will vary somewhat from it. But it furnishes some idea of where the money goes.

By coordinating the public works departments of the cities with the airport maintenance departments, many have found great savings possible. Airport directors and their assistants receive salaries ranging from $1,800 to $6,500 in airports having more than 100 transport movements monthly, according to data compiled by Municipal Finance Officers Association of the United States and Canada. Some receive free living quarters valued at from $25 to $60 monthly. Some have allowances for private car of $10 to $50 a month. Salaries of all airport employees are being compared, with a view toward adjusting them to some sort of fair standards. And then further savings are coming through simply by using sound horse sense in airport management. For example, they don't haul out the snow shovels every time it snows. They clean off the runways only when a plane is likely to be landing there.

There's getting to be a lot more sense used in handling airport dollars. First step the municipal leaders are contemplating is the compilation of more information about airports; costs and operation, preparing this in standardized form and disseminating that information where it will do the most good. The CAA is assumed to be the logical body to take leadership in this activity.

It's the first step in a campaign to run airports intelligently, on a sound financial basis. They're mostly just talking about it, but action is starting in a few of the places—and there's a lot more to come.

END

TABLE V

PAYMENTS FOR LANDING AND FLOOD LIGHTS

City	Terminal Class	Population Class	Approximate Annual Income from Source (1939)	Explanation
San Diego, Cal.	III	C	$112	Charge of $1 per hour for lights for night flying.
Little Rock, Ark.	IV	C		No charge except for ship desiring to shoot landings over a period of time—then it is $2 per hour.
Charlotte, N. C.	III	C		Boundary lights—$1 per hour. Flood lights —$2 per hour.

TABLE VI

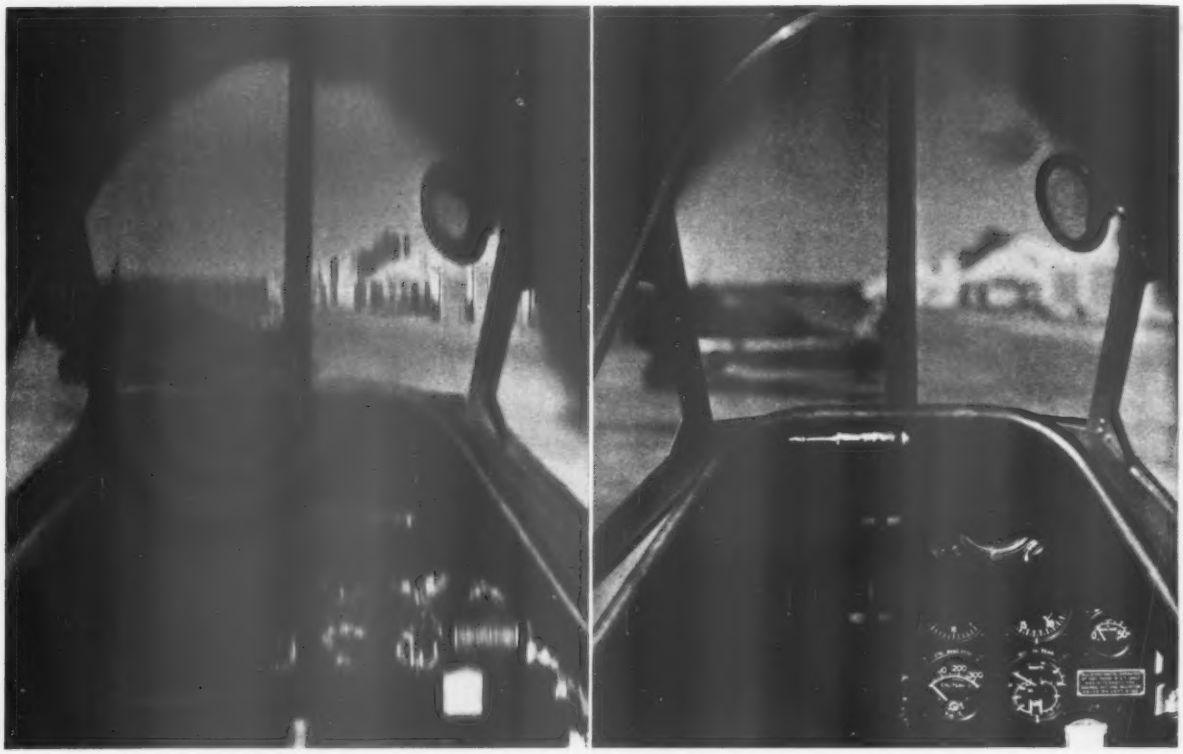
INCOME FROM GROUND RENTALS AND OFFICE SPACE

City	Terminal Class	Population Class	Approximate Annual Income from Source (1939)	Description of Sources, etc.
San Diego, Cal.	III	B	$8,565.66	Transport Co.—Ground rental: 25 yr. leases: 1st five years $ 50 per month 2nd five years 75 per month 3rd five years 100 per month 4th five years 125 per month 5th five years 150 per month (space average) 100′ x 100′ School—35 yr. ground lease: 1st five years $50 per month 2nd five years Not to exceed $ 75 per mo. 3rd five years Not to exceed 100 per mo. 4th five years Not to exceed 125 per mo. 5th five years Not to exceed 150 per mo. 6th five years Not to exceed 175 per mo. 7th five years Not to exceed 200 per mo. Auto Service Station pays—10 yr. lease: 5 yrs. @ 4c per sq. ft. 5 yrs. @ 7c per sq. ft. 20 yr. leases: 5 yrs. @ 4c per sq. ft. 5 yrs. @ 6c per sq. ft. 5 yrs. @ 8c per sq. ft. 5 yrs. @ 10c per sq. ft. Manufacturing plants, except one which receives special flat rate of $1,750 per year: 15 yr. leases: 1st yr. $125 per month 2nd yr. 150 per month Next 3 yrs. 175 per month Next 3 yrs. 200 per month Next 2 yrs. 225 per month Next 5 yrs. Not to exceed $300 per mo. 15 yr. option: 1st 5 yrs. Minimum $300 per mo.—Max. $400 2nd 5 yrs. Minimum 350 per mo.—Max. 450 3rd 5 yrs. Minimum 450 per mo.—Max. 500
Little Rock, Ark.	IV	C	780	American pays $45 per month for office rent American pays 20 per month ground rental on a vacant lot on which they might construct their own office.

TABLE VII

INCOME FROM GOVERNMENTAL AGENCIES

City	Terminal Class	Population Class	Approximate Annual Income from Source (1939)	Description of Sources, etc.
Knoxville, Tenn.	IV	B	$240	Weather Bureau pays $20 per month toward upkeep of lights, heat, and janitor service.
Little Rock, Ark.	IV	C	240	CAA pays $20 per month rent for quarters.
Houston, Tex.	III	B		CAA pays $20; Weather Bureau $35.
Harrisburg, Pa.	II	C	1	Weather Bureau and CAB pay $1 per yr. space rental.
Memphis, Tenn.	III	B	366	CAA Comm. Sect. pays $1 per year rent plus $365 per year to take care of light, heat and janitor service.
Nashville, Tenn.	II	B	240	CAA pays $20 per month office rental. Hangar space is donated free. Weather Bureau and Post Office receive free space, and Tenn. National Guard receives free use of field, light and water also without charge.
Utica, N. Y.			None	Governmental agencies get rent free.
Moline, Ill.			900	Representing actual cost to city for providing heat, light, water and janitor service in the Administration building for 1,300 square feet of space used by the Communications Section of CAB. General Inspection Service of CAB utilizes 144 square feet of space without charge.
Billings, Mont.			1,020	Weather Bureau pays $30 per month for 855 square feet; CAB pays $25 per month for 425 square feet. Both include light and heat. Post Office Department has separate building (16′ x 24′) for which rent of $30 per month is paid by the scheduled air carriers. Weather Bureau has balloon shed built by the Government from which city gets no income or ground rental.



The four photographs across this and the opposite page illustrate typical eye problems. Above (left) is the way things would look in a plane cockpit to a person having astigmatism. View at right shows near-sightedness (myopia).

PILOT—Your Eyes..

by Dr. JAMES M. SCHAFFER

Photographs by Dmitri Kessel from Life Magazine

Nothing concerns the flyer more than his eyes. Yet he knows little about their many peculiarities, although he should

In addition to being an eye expert, Dr. James M. Schaffer is a veteran pilot. A lieutenant in the Army Air Corps reserve, he also flies for sport, having 380 hours in his log book as this was written. A Chicagoan, Dr. Schaffer earned a B.S. degree in aeronautical engineering at the University of Minnesota. Now a member of the research department of the Northern Illinois College of Optometry, he specializes in orthoptics.—Ed.

CANADA needed some pilots badly—and quickly. In both the United States and Canada a flock of flyers were biting their fingernails in chagrin at being grounded and not having a chance to try whipping the daylights out of some fellows over in Europe they didn't like. These flyers and would-be ones were grounded because they had eye trouble—"errors" as the optical world knows them—which could be corrected by lenses. Take the specs off a pilot who needs them to see correctly, though and his life isn't worth a plugged nickel.

Well, the aviators wanted to fly for the British Empire and John Bull wanted them to fly for him too, so they got together and worked things out beautifully between them. In New York the pilots were (and are) being fitted with contact lenses. Then the RCAF examined them. Soon a bunch of new men were flying. With the contact lenses, their eyes were as good as normal. It's quite possible that the United States may follow Canada's suit in this program, after officials have seen how well the practice works out with the Canadian flyers.

In tests we've conducted here at the Northern Illinois College of Optometry and in all others tried throughout the country, both in laboratories and in practical service, *no contact lens has ever broken while on the eye of the wearer.* In order for these lenses to break, the blow would have to be of sufficient power to damage the eye, glass or no glass. The eye serves partially to cushion any impact against the lens.

Up to three years ago only 40 per cent of the people with eye trouble could be fitted with contact lenses. Now 85 per cent can. This is due to improvements in the lens manufacture and increased familiarity with this type of optical work by practitioners. The 15 per cent who can't be fitted are the nervous, sensitive sort who are irritated by these outside objects touching their eyeballs. It's like some folks being more ticklish than others.

All this doesn't mean much in this country yet, but it offers a pretty strong

Farsightedness is illustrated above (left). Picture at right shows the same scene as viewed by a pilot with perfect visual acuity. Obviously, a pilot with anything other than perfect vision could easily prove dangerous.

ray of hope for those flyers who are disgruntled at having their eyes keep them out of the air. We'll know more about it after the war's over.

Probably those of us who are aviation-minded are more eye-conscious than the average fellow. A couple of kids start building model airplanes together and plan all the things they'll do when they get their first honest-to-gosh plane. They go through a lot of years of dreaming together and finally get to the stage where they're being examined for licenses. One passes. The other doesn't on account of his eyes. It hurts a lot, but he congratulates his buddy and doesn't fool anyone when he tries to act as though he doesn't give a hoot about not passing.

Incidents like this—we all know of a few—give a bunch of aviation enthusiasts the jitters. They worry about eyes, theirs and everyone else's. Fortunately the eye, although the most complicated organ of the body, is an organ that we know something about. Knowing something about it, we can correct many of the eye errors by use of eye exercise (orthoptics) and corrective lenses, before they become too severe. It may take years, but that's better than a lifetime of faulty vision.

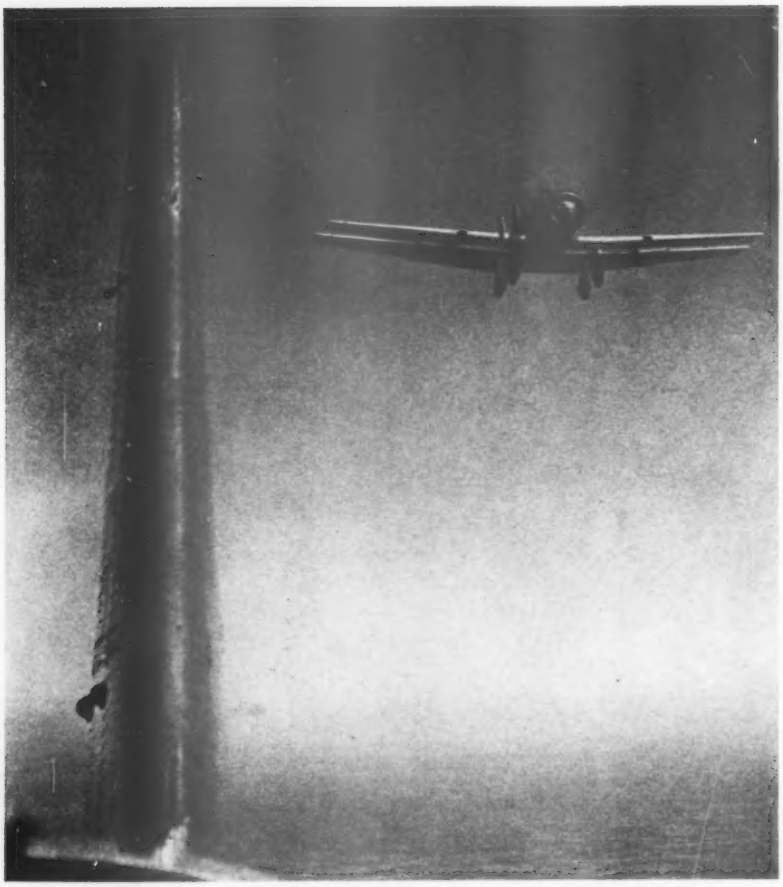
Now in this discussion we'll confine ourselves to errors of eyesight which are common abnormalities not the result of accidents, vision-impairing growths, diseases and the like.

The examination given pilots is no more severe than that given patients by any competent eye specialist. The major difference lies in the fact that many non-aviation eye examinations are too superficial and hasty to be accurate. Recent graduates of recognized schools and colleges of optometry, or the veteran optical scientists who have kept up with current work in the field and that done in the past 10 years (as by the optometric extension program), are good bets as examiners. Also, the eye specialist with his own well-equipped office, who takes time to do a thorough job, is more likely to prescribe satisfactory lenses and/or exercises, than the white-coat in the department or credit jewelry store who is in the eyeglass business.

One of the most important examinations given the eyes is for "V.A." or visual acuity. This is the ability to see well, both far and near. A normal V.A.

JAMES M. SCHAFFER

One solution for correcting pilots' eye weaknesses without making them wear glasses is the recently-perfected contact lens. It is fitted with tiny rubber suction cup.



Not an uncommon eye trouble is double vision. This photograph shows the effect this affliction would have on a pilot in the air. Double vision is due to weak muscles.

is 20/20, which means that the eye can see a letter at 20 feet that is designed to be seen at 20 feet. This letter is of a height that subtends a five minute angle at 20 feet. If you're stale on your geometry, a degree is the little unit wedge you'd have if you cut a pie (in this case one with a 20-foot radius) into 360 equal-sized slices. A minute 1/60 of a degree. Therefore the five minute angle would be the long, skinny wedge left if you divide the one degree into 12 equal parts along the arc. The letter would be the height of the little odd side of the resulting isosceles triangle.

If the ability to see this small a letter isn't there, the person being tested is either moved closer or shown letters that subtend larger angles until the accuracy of his vision is determined. It may be 20/30 or 20/40, the larger number representing a more readily visible letter. If the vision is 20/10 the eyesight is better than normal; the tests show the eyes able to see a letter that subtends a much smaller than standard angle from the 20-foot distance.

Another key examination is for stereopsis or depth perception. The fellow driving a car has to gauge distances pretty accurately when he's passing or parking—and I'd hate to be flying with a pilot landing a plane who couldn't judge how far he was from the ground. For this test, the person being examined is seated 20 feet from a box containing two pins. One is stationary. The other's on a track. He's given two strings, one to pull the pin on the track away from him and the other to pull it toward him. He tries to line the two pins directly across from one another. He's allowed an error of 12 mm. (about ½ inch) on either side of the stationary pin.

This three-dimensional vision plays a big part in marksmanship, all sorts of construction work or machine operation, sports and almost every other human activity involving making contact between two objects or locating a point in space. We call it binocular stereoscopic vision. It indicates when the two eyes are working together in perfect harmony. Each may have perfect vision, but they may have poor teamwork between them. If one eye is normal and the other abnormal, the binocular vision is impaired and imperfect and the patient tends to use only the good eye to make himself more comfortable. It's a sort of involuntary defense effort to get rid of the blurred image. This pin-aligning test reveals these conditions. It may even reveal the amblyopia, a dimness or dullness of vision in one eye which causes the owner of that eye to use the other in preference to it.

A third test is for peripheral vision, the ability to see an object without looking at it. There's a dot on the center of a large half circle. The person being tested looks at this dot and the tester causes different colored lights to converge slowly on it, like a target. The light patterns are seen, according to their color, at different distances from the dot. Blue is the one recognized farthest out; red and green are visible in the smallest area. This test also reveals many instances of color blindness.

Similarly, other tests which may seem a little wacky to the fellow being examined reveal more about his eyes than he probably imagined *could* be revealed. The reports from the set of tests are assembled and interpreted and there's a fairly complete story of the perfection or imperfection of a pair of eyes.

The errors fall into six major classes:

1. Hyperopia, or far-sightedness.
2. Myopia, or near-sightedness.
3. Astigmatism, or unequal curvature of the eyeball, causing objects to seem disproportionate.
4. Presbyopia, or loss of elasticity of eye muscles due to old age.
5. Diplopia, or double vision, which causes each eye to see different images.
6. Binocular imbalance, or poor coordination resulting in loss of depth perception and often leading to diplopia.

Of these there's some hope of curing many cases of all types, except the very natural one of presbyopia, which may be compensated for by the use of reading or eye glasses.

Orthoptics have proved strikingly successful in many cases of diplopia and binocular imbalance. This may be muscular unbalance or a bad hook-up between the eyes. Binocular coordination may be regained in many cases by the use of certain instruments to exercise the eye and home exercises prescribed by a competent eye specialist.

These exercises serve to coordinate the action of the eye muscles so that in time they can exert a balanced pull on the eye sufficient to counteract the original tendency which draws the eye out of line.

Poor coordination of the action of the eye muscles has several classifications, the names of which are sometimes confusing. When the eyes turn toward one another, the trouble is called esophoria. When they turn away it's exophoria. When they see at different horizontal levels it's hyperphoria.

The other three eye troubles can be corrected with lenses—which the Air Corps won't approve at this writing. Many of these cases develop improvements, thanks to maturity, or orthoptic training or corrective lenses may slowly fade the error away. This might require a number of years, but it's a well-invested effort if it brings a person perfect eyesight.

These three errors of the eye cause things to fall into focus improperly. The hyperope sees well at a distance but close objects may appear blurred. The hyperope, or far-sighted person, does not, as many people believe, see better at a distance than a normal person does. He

(*Continued on page* 90)

The PYLON EIGHT

by JOHN R. HOYT

The pylon eight is one of the most difficult flight test maneuvers. This article explains its factors and how it is done.

DO you, as one of the 82,000 pilots and student pilots in the United States, know that the pylon eight is required on all CAA flight tests? Can you do a pylon eight well enough for your private certificate? Or, if you already possess one, can you demonstrate the harder type of eight required for a commercial license? And finally, after having acquired your license, can you *teach* a pylon eight well enough for your instructor's rating?

Questions are asked daily about the pylon eight. It is, without doubt, one of the hardest maneuvers required on any of the three flight tests just mentioned, necessitating smoothness, planning, precision and the ability to fly the airplane while concentrating on a ground object. For example, suppose that you are doing a pylon eight. You look at the pylon (which may be a fence corner, a small tree, or a bush) and, without removing your eyes from the pylon, you bank the airplane and turn around the object. Your subconscious realization of stability, bank, air speed and direction must be depended upon to fly safely, correctly and precisely. All the time you are concentrating on the pylon, it is necessary to remember to coordinate the controls, to maintain altitude and to reserve part of your attention for that simulated emergency landing sure to come.

How does one do it—what *is* a pylon eight? The answer should not be, as a certain instructor replied, "A pylon eight is just an eight done on or around a pylon." Although that answer is correct, it doesn't satisfy and, while it is true that the figure should resemble an "8", such an answer will result in a figure that looks more than anything else like a distorted pretzel.

Another question has been asked—and it is estimated that not one instructor in 10 knows the answer: "At exactly what altitude must a pilot fly an airplane to hold the pylon?" In other words, upon what factor does the choice of altitude depend and how would it be determined for a given airplane? The answer to this question will be a distinct surprise to many pilots and instructors. To formulate the answer, let us begin by first learning the simpler or elementary type of eight called "eights around pylons." This maneuver is required for the private pilot's flight test and there are a few points of major importance that should always be stressed.

First, in leaving the airport to practice pylons a good pilot will remove himself from areas of air traffic and habitation. If he wants to lose friends and alienate farmers from aviation, let him pick pylons near a team of jittery horses, or do a dozen or two over the farmer's house and barn. On the other hand, if pilots would preserve good will let them pick objects away from communities, or an out of the way crossroad. And in picking them, the pilot must be sure that the two objects lie crosswind. That is, a line joining two north-south pylons would receive the wind from the east or west.

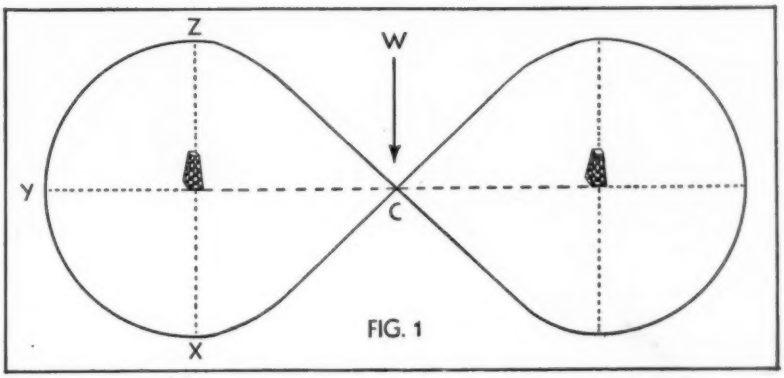


FIG. 1

This illustration diagrams the procedure for performance of "eights around pylons."

After picking them, one should not commit the unpardonable sin of making the first turn downwind. Many flight examiners will disqualify a student applicant on his flight test for such an offense because it indicates a lack of attention to planning and an absence of presence of mind. The best way to avoid such a calamity is to form the habit of beginning the maneuver by flying downward *between* the pylons. Thus a turn in either direction must bring the plane upwind.

The moment to begin this upwind turn is usually confusing to the student because he somehow fails to realize that the distance from the pylon invariably is what determines which type of eight he will do: that is, the shallow eight is farther from the pylon than the steep eight.

This distance now becomes like the spoke of a giant wheel. The pilot may visualize several spokes branching outward from his pylon, each the same length and each passing through some particular marker such as a tree, clump of bushes, or post. As the plane passes over the first marker, which should be abreast the pylon and downwind from it (see Figure 1, Point X), the pilot must immediately select the next spot over which to fly. (Figure 1, Point Y.) By banking the plane and flying over this spot, a perfect pattern will be formed. After flying over this one, the next one is chosen (Point Z) and the bank varied according to wind conditions.

The wind, naturally tends to drift the plane toward the pylon and some pilots

The hard-to-do "eight on pylon" is made clear by this article and the diagram below.

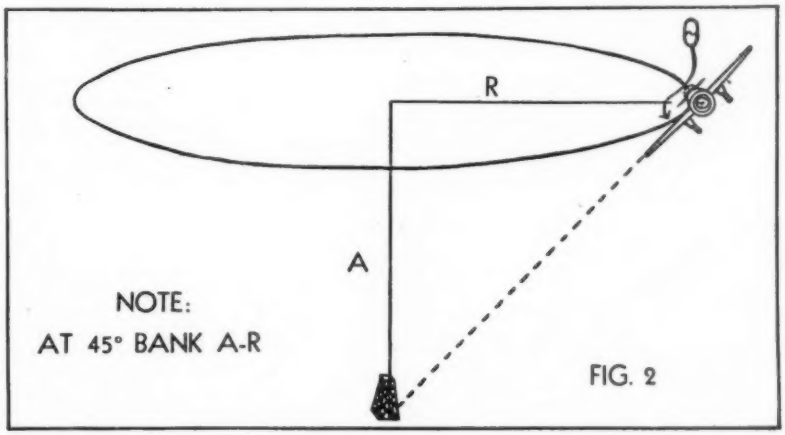


FIG. 2

like to remember a rule, such as this: "Shallow the bank on the upwind side." Therefore, in trying to fly over the marker, it will be necessary to vary the bank in order to maintain position.

Likewise, the wind must be taken into account when the plane is levelled off and headed toward the other pylon. If the plane is headed slightly upwind the drift will carry it over the desired point. The best way to make good the point is to attempt to fly over the exact center of an imaginary line between the pylons (Figure 1, Point C). This center should be noted visually, and remembered, not as a vague point, but by what happens to be there, such as a small tree, fence intersection, post, clump of bushes, or water. Whatever it is—fly over it. If the wind is more or less than the estimate, make a proper correction for it the next time around.

The other pylon should be done precisely as the first. During the flying a subconscious realization of altitude, bank, speed, coordination and feel must be developed. It does little good to whip the airplane viciously into one bank after another, alternately climbing and diving, skidding and slipping. Of course, the qualities of feel (kinesthesia) and subconscious realization will be further developed by the harder type of eights to follow.

The "8" being made on the ground should now be symmetrical. If the pylons are very close the eight will be "fat," if the pylons are far apart, the eight will be quite a long drink of water. In general, one should limit the distance between them by the length of time required to fly from one to the other. Ten seconds is plenty long enough to use in this manner.

After several shallow eights have been accomplished, the flight examiner usually requests some steep eights. This is nothing to become alarmed about as many students are inclined to be, because all they need to change is the distance or radius of the pylon. Naturally, the closer one flies to an object, the steeper one must bank in order to fly around it. The technique just described remains the same and the only precaution to be observed is this: Don't get so close that the bank will be steeper than the capability of plane or pilot. A bank of 50° is steep enough; in fact, it looks to the pilot as though it were 89½°!

One last point. Many students and instructors are confused as to the height required for these eights. They believed that they must be done at a certain altitude, whereas in reality 600 or 800 feet are selected for reasons of safety and expediency. That is, from 2,000 feet one would be safe but the ground objects would be too small to be seen plainly. On the other hand, one could see perfectly from 200 feet, but a forced landing would be a distinct hazard. Therefore, one must try to mediate between the two and select an altitude that will be most advantageous all the way around.

With elementary maneuvers approved, the private pilot turns to the very difficult eight *on* pylons. But like every-

(*Continued on page 74*)

I LEARNED ABOUT FLYING FROM THAT!—NO. 31

by DEVON FRANCIS

It's best not to try and beat out threatening weather. The smart pilot will stay on the ground.

THE weather was not good, but it was not bad. The clouds were in two layers, both broken. For an hour drizzles had come intermittently from the scud below.

My route was Lock Haven, Pa., to Flushing Airport, just east of LaGuardia Field. I had flown solo over the eastern Pennsylvania "hills"—some of the ridges rise to 2,000 feet—before, and had a mind's eye picture of the terrain and route.

The boys at the field had their tongues in their cheeks. They could clear me out of the field on the basis of the weather forecast, they said, but maybe it would be a good idea to wait a spell.

"Why?" I asked. I was anxious to get started.

"Funny weather over these mountains," was the reply. "Lot of stuffed clouds. You might hit one."

But I was insistent.

"Tell you what I'll do," I proposed. "I'll stay right on course and watch the stuff. If things look all right when I cross the Susquehanna, I'll go ahead. If they don't I'll turn right around and come back."

Then, to clinch the argument, I added, "I can follow the river valley right back to Lock Haven, you see, if the stuff begins coming down on my head."

It seemed to be clearing as I fastened my belt. An occasional shaft of sunlight came through. The job was a *Cub Cruiser* with a 75 h.p. engine. I had felt it out on a check flight and had been surprised at its pleasant landing characteristics. Because the tail rides high when the ship is at rest, the amount of backward stick travel at the moment of full stall is negligible.

At the end of the runway I braked the ship to cross-wind position, ran up the engine, tested the mags and wheeled upwind. I took off. That was mistake No. 1.

I took my time climbing, scanning the clouds for 360° as I gained altitude. It did not look bad at all. Coming back downwind, I had 2,500 feet and set off across the first ridge enclosing the winding river. Ahead of me, almost at right-angles to my course, the stream made a 90° turn. Almost immediately the scud began bothering me and I turned right at 45° toward a lighter spot. I was not more than three miles south of my course when the river appeared. I spotted a check point, headed slightly south of east and checked both the deviation and variation of the compass. So far, so good.

Here the terrain played out, affording me plenty of places to get down in case of engine trouble. I was about to lean back with a sigh of satisfaction and light a cigarette when scud began whipping by the ship. Rain spattered against the windscreen. I throttled back and nosed down, an eye on the altimeter and the tops of the hills. Should I, or should I not, turn back? The return to the airport would be easy. I knew that. But from 2,000 feet light spots appeared ahead and it was hard to give up the quest. I decided to go on.

That was Mistake No. 2.

Now it was nip-and-tuck with the scud. I couldn't get over a 2,000-foot ridge without pulling up into the stuff and I was no instrument flyer. I reasoned that I could go through a notch in the range at the right, keeping a valley of a branch of the Susquehanna in sight for

(*Continued on page 80*)

Devon Francis is one of the country's leading authoritative aviation writers. Aviation editor of the Associated Press system, he has flown in almost every hemisphere. In his spare time, he is a private pilot. He is president and one of the founders of the Aviation Writers' Association, was a newspaperman in Denver, Colo., before joining the AP and moving to Jackson Heights, Long Island, New York, where he now lives.—Ed.

Devon Francis.

He Flies the Range

The flying range boss lands his "Cub Coupe" near a water hole and gives cowhands daily orders.

by ALMA HEFLIN

Malcolm Madera is a cattleman who owns 12,600 acres of grazing land near Jal, N. M. It takes a plane to survey the ranch.

THE posse was sweeping down the canyon. In the shack the Pecos Kid cradled his six-guns in his big hands. Things were plenty tough and getting tougher on every page . . .

The kid under the mesquite bush shoved the magazine out of sight. The gun battle could wait. A drone out of the west warned him the boss was riding the range today and it was no time for reading cowboy yarns. He grabbed the trailing reins of his cayuse and swung into the saddle as the yellow and blue *Cub* came into view, flew low around the shoulder of the butte and landed.

The boss stepped out as Slim loped up. "There's some mavericks down in that arroyo by the creek," he told the man on the horse. "Round 'em up and get 'em with the main herd. I'll fly the trail tomorrow when Blackie starts 'em to the railroad, but there shouldn't be any trouble. Flew it today and there's plenty of water. Soon as you pick up the dogies, get over and fix the fence line along the north butte. I spotted a place where it's down."

"Sure thing, boss. How's the cactus-proof tires holdin' up?" They chatted for a minute about tires and then the boss stepped back into the plane.

"Swing the prop, eh Slim?" he said. "It's on contact."

The plane cut a dusty path through the bunch-grass and bumped into the air. Slim loped off toward the arroyo. The boss' plane made it easier to check on strays and fences and water-holes, but it was sure hard on a guy's reading. Never knew when he was going to drop down out of the sky.

Malcolm Madera owns 12,600 acres of grazing land about 35 miles outside of Jal, N. M., a cow town of 1,500 people. The Maderas lived on the ranch, but even over the rough winding roads their big Buick could make pretty good time if they cared to drive in on Saturday night.

Then Jal struck oil. Water is always the biggest problem of all problems of living in the cow-country. Ranches are big, not because of land-greed, but because so little rain falls that it takes at least 15 acres with its thin forage to feed each head of stock. And, when they started drilling for oil, water moved into the class with gold dust. It takes 30 days to drill an oil well and the crew uses 2,000 barrels of water a day.

Madera had the water on his range. Madera and a company he formed could get water on other ranches. But the water was not at the oil fields. Pipelines had to be laid. They had to be checked all along their length, for a tiny spot of moist earth that would mean that a leak was drizzling the precious water into the thirsty ground at a rapid rate.

The investment was heavy and, having laid in equipment for assuring a steady water supply, Madera had to keep it operating. Headquarters for the oil companies, which could give him new contracts for supplying the crews of new projects, were in Dallas and Oklahoma City. That was a trip of 450 miles as the crow flies. Roads were none too good and the round trip could hardly be made in less than two days.

Madera had his hands full. The new water supply business was a job in itself. But out on his range he was running nearly 500 head of white-faced Herefords and, between trips across two

(*Continued on page* 86)

The Maderas are one of New Mexico's most air-minded families. Even one-year-old Lee Ellen feels at home astride the strut of the family airplane. Mrs. Madera is at left.

The RAF in the USA

by DONN HALE MUNSON

This class of RAF students is answering roll call at the Camden, S. C., school. This base has 65 ships.

The British have arrived and they love it. U. S. Army and Navy schools train Royal Air Force pilots as well as Americans.

These three British fledglings got their first taste of watermelon in Carolina.

THE reception they received when they ended their 5,000-mile trip from England to Florida was typically American. Ninety-nine fledgling Royal Air Force cadets grinned through their travel grime and forgot about red eyes and weariness from two days and nights of daycoach travel, when the little cow-country town of Arcadia turned out almost en masse to welcome them.

The last group of 550 to detrain, the Arcadia boys could not restrain their eagerness to get into the air and as hospitable southerners served them with refreshments the question on every pair of English lips was the same:

"When do we fly?"

Some of them had been with the RAF nearly a year, others only a few months, yet the question provoked real American reaction. Said one youngster:

"It didn't seem but a few minutes after we first asked that question here when they had us all out to the field—and there we were, face-to-face with the training ships."

Now, after nearly a month of primary training, most of them have soloed. The group came to Arcadia via Detroit, Cincinnati, Chattanooga and Jacksonville after weeks in a Toronto manning center. Other groups dropped off in seven other of the southeast's elementary flying schools. Operated under direction of the War Department, they are at Albany,

Ga., Americus, Ga., Lakeland, Fla., Camden, S. C., Jackson, Miss., Tuscaloosa, Ala., and Coral Gables, Fla.

Arcadia's Embry-Riddle school is typical of similar schools, perhaps a bit more elaborate and favored with better weather. Training berths in eight schools were opened June 4, when the War Department made public the fact that Britons were to be trained; it was just five days later that the fledglings were in the South beginning their training.

When Arcadians had completed their welcome to the boys and when the last Britisher had exchanged smiles with the gayly costumed cowgirls of the section, the RAF lads settled down to the routine. They gaped in awe at the Arcadia layout: Carlstrom Field, the big shining metal hangars, the 65 or more Stearman PT-15 trainers, the $300,000 worth of barracks, swimming pools, tennis courts, canteen, recreation hall, mess hall and other facilities.

"I say!" breathed one lad in amazement, "the RAF will turn green with envy when it hears about this."

He couldn't believe the spacious sleeping room in the spotless new barrack was to be his and that he had to share it with but three other cadets. He cautiously tried out his bunk, peered into the showers and sucked a tasty orange.

"It's heaven," he said.

The system is simple. The 550 Britons simply became lowerclassmen in American flying schools. At Arcadia, the present upper class is made up of 250 cadets of the U.S. Army Air Corps. The RAF men, ranging from 18 to 30 years of age, live in one big barrack and the Americans in another. All cadets use the same mess hall and recreational facilities.

Albert I. Lodwick, co-owner of the civilian-operated school, explains it this way:

"We are making every effort to provide British students with various kinds of food and other things to which they are accustomed at home. For instance, we have purchased many of their favorite phonograph records of the songs they like and are used to singing. As many of the boys are fond of darts, we have equipped our recreational rooms with these games. We have arranged contests and games of various sorts between the Americans and the British."

The group at Arcadia is a cross section of English life. In civil life the boys who now are devoting their times to spot landings and climbing turns were hunched over desks, standing behind counters, working in factories, ringing doorbells as salesmen or collecting bad bills. Practically every profession is represented. Take Douglas May for example. Thirty years old and married, the father of a little girl, he's admittedly no youngster. His helmet covers a bald spot and his khaki covers a slender frame. He was manager of a London clothing store when he joined the RAF.

"Why did I leave 'em?" he answers when asked why he left his family to come 5,000 miles to learn to fly, "There's a job to be done and I'm just doing my bit."

May, like many of the others, doesn't

Typical of U.S. hospitality was a recent short wave broadcast to England for RAF men.

RAF cadets are confined to carefully-guarded Army air base except on week-ends. Young Englishmen below are typical of the 8,000-per-year to be trained by U.S. Army alone.

British cadets are treated exactly as are Americans, including a dunking in water when they solo. RAF students go from primary to basic, then advanced, flying schools.

even bother to read American papers to see how his countrymen are doing in the battle of Britain. To date he hadn't had a letter from home. He'd had one cablegram to the effect that all was well at home and that's all he is interested in.

"What can I do but induce worries if I read the papers? I'm much too busy learning to fly and to fight. If anything happens to my family I'll hear about it. Meantime what I, and all the rest of the boys, are learning here will soon be put to work and we'll have first hand information on what's going on. For we'll be right up there, you see."

Despite all the efforts on the part of Embry-Riddle officials to make the Arcadia field and barracks as English and homelike as possible, the Britishers are not terribly concerned. They are in love with America and Florida.

"I've never dreamed there was such a big, lush, wonderful land," Yorkshireman Alec Barrett says in his thick brogue. He flies, studies, he snoozes in the hot semi-tropical sun and he ogles at America. Like most of the 99 others, he's never without an American cigarette in his hand or within reach. The RAF boys are passionately fond of the popular brands of American smokes. They have become attached to soft drinks, hot dogs and hamburgers. The canteen at Arcadia is usually full to overflowing with hungry Britishers and the sign on the cigarette machine warns:

"Money of Canada and Britain will not fit this machine!"

Officially known as Class 42-A, the boys quickly became acclimated. Flight schedules began on June 11 and progress was the same as in any U.S. Army flight school. Treated exactly the same as our own flying cadets, the British must pass the same physical examinations, must obey the same regulations and a few additional and typically English regulations, have the same privileges, and their experiences seem to be the same.

Typical of how they came from their homes in England is the story of Thomas D. Leslie. A resident of Surrey, a few miles from London, he dashed to the recruiting center when war was declared by England. For many months he waited, still retaining his job as an insurance salesman. The war was far away for him, despite the Stukas that swept down on his area and despite the bombs that fell "within a hundred yards or so, old, boy. Really nothing to worry about. They don't hurt 'til they hit you."

Leslie, who is 20 and on the tall side, was playing tennis when the Germans bombed Croydon airport.

"We were batting the ball about when we heard some planes approaching, quite low. We couldn't see whether they were German or English," he recalls, "so we just kept on playing. The courts were quite close to Croydon and slightly higher, so we had a perfect picture of what was happening. The ships came closer and we suddenly realized they were Jerry. They swept down with terribly fascinating beauty and gave the 'drome hell. I was so close I could see the bombs leave the racks and splash on the field."

Leslie tells the story as coolly as if he were relating a family incident. His reaction to the bombing is, in itself, illustrative of how all 99 of the Britons react to the war. The only thing exciting to them is that they are in America, the country with all its strange ways of living, with all its richness and novelty. Then there is the thought of the future.

"I want to be in fighters," says Leslie.

"Rather!" drawls Barrett.

"Same here," echoes Fred Chesney, from Sunderland, County Durham.

"I say, chaps," interrupts May, a Londoner—the man with the family at home —"I prefer patrol work, you know. Sitting up there in a Short *Sunderland*, doing a bit of coastal defense."

The others scoff at him, reminding him it's old man's work, patrolling the sea. May, grinning, reminds them he *is* old.

The boys have seen action. Yet they haven't taken an active part. May says:

"Soon after the fall of France I enlisted, although I was exempt because of my wife and child. Lots of other lads joined up at the same time and while

(*Continued on page 76*)

Typical of U.S.-RAF close coordination are Lieut. H. C. Huglin of the U.S. Army (left) and RAF Flt. Lieut. J. L. Keith, both on duty at Southern Aviation School, Camden, S. C.

How to Determine Range

by PEYTON AUTRY

Continually increasing in importance both to designers and owners of airplanes is the problem of range. This article tells how to calculate it most easily.

WITH the progress of aviation and, consequently, airplane design, the range of the airplane has increasingly become an outstanding factor in performance. Several years previous to the aviation we now know, airplanes only were required to make the extended journeys of today under special conditions and special arrangements had to be made for the special requirement.

At the present every designer and manufacturer has *range* as an uppermost thought in his mind when performance decisions must be made. From the 40 h.p. lightplane to the multi-engined flying boat, private buyers and procurement divisions of airlines, Army and Navy are saying yes to increases in range. These increases over several years ago are largely due to more efficiency in lifting power and reduction of structural weight, which makes for greater fuel capacity. Also, the much greater cleanness of the airplane today and improvements in propellers and engines have much bearing on the range in a more or less of an automatic trend.

The accompanying chart can be depended upon for accuracy when the items calculated by simple arithmetic are the true and known values of the airplane in question. However, a close approximation can be had without further reference away from the material given here if ordinary judgment is used.

For those who may be interested in the inner workings and derivation of the chart, it has been plotted within a design working range from the Breguet equation, which is comparatively well known to most designers and engineers—being referred to in various aeronautical literature. The Breguet equation for range is:

$$R = 863 (L/D) (n/c) \log (Wg/Wo)$$

Where the ratio of lift to drag L/D is the value for the overall airplane, n is the propeller efficiency, c the specific fuel consumption in lbs./BHP/hr., Wg is the gross weight and Wo is the gross weight minus the fuel load in pounds.

If the true values of these variable factors are not known average values as follows may be used.

n, ... .75 to .85
(.75 for wood props and .85 for controllable pitch)
c, ... .45 to .60 lbs./BHP/hr.
L/D, Class 1 airplane..... 8.00
L/D, Class 2 airplane..... 9.00
L/D, Class 3 airplane.....10.00
L/D, Class 4 airplane.....11.00
L/D, Class 5 airplane.....12.00
L/D, Class 6 airplane.....above 12.00

For figuring the value Wg/Wo the weight of a gallon of gasoline is six pounds.

A description of the six airplane classes for lift drag ratio obviously must follow:

Class 1: Airplanes having excessive drag.

Class 2: Present day biplane or externally braced monoplane, streamlined fuselage, engine cowl or ring.

Class 3: (a) Cantilever or wire-braced monoplane with streamline fuselage, cantilever or wire braced landing gear, wheel pants, engine cowl or ring. (b) *or* biplane or externally braced monoplane, with streamline fuselage, retractable landing gear, engine cowl or ring.

Class 4: Cantilever monoplane with retractable landing gear, streamlined fuselage, well cowled engine, no external bracing.

Class 5: Same as Class 4 except landing gear retracts flush with wing (well covers over gear), wing and tail fillets, round or elliptical section fuselage well streamlined. Round or elliptical wing tips. No protruding rivets on forward part of wing (if all-metal).

Class 6: Same as Class 5 with any further improvements toward aerodynamic cleanness; retractable tail wheel; flush rivets and laps (if all-metal); completely enclosed engine or engines in perfectly streamline cowl or nacelles.

The factor (L/D) (n/c) is plotted as the base of the chart. This is the lift-drag ratio multiplied by the quantity (n/c), the latter which is the propeller efficiency divided by the specific fuel consumption. When this complete factor is found the ordinate through the chart is known, or a vertical line rising from the base to intersect the straight line curves or plottings. The curve to be used must next be calculated. This, done by figuring the weight of the fuel carried (lbs. fuel = fuel in gals. x 6) and subtracting from the gross weight, is the value Wo. Wo divided into the gross weight gives the ratio Wg/Wo. We then know the curve for the particular case, either exactly or approximately on the chart. The intersection of the ordinate and the curve gives a point when extended to the left side falls on the range of the airplane.

Example: Let us assume we have an airplane with ordinarily well-faired fuselage of composite type construction, cantilever monoplane wing, cantilever landing gear struts with wheel pants and NACA radial engine cowl. It will then fall under Class 3. Propeller is adjustable metal with efficiency of .80. Gross weight is 2,300 lbs., fuel capacity is 50 gallons. At cruising speed the engine r.p.m. will give a specifie fuel consumption of .50 lbs./BHP/hr.

Fuel weight = 50 x 6 = 300 lbs.

Wo = Wg − 300 = 2300 − 300 = 2,000 pounds.

Wg/Wo = 2300/200 = 1.15

(The third solid line curve from the bottom in the chart will then be used for this airplane)

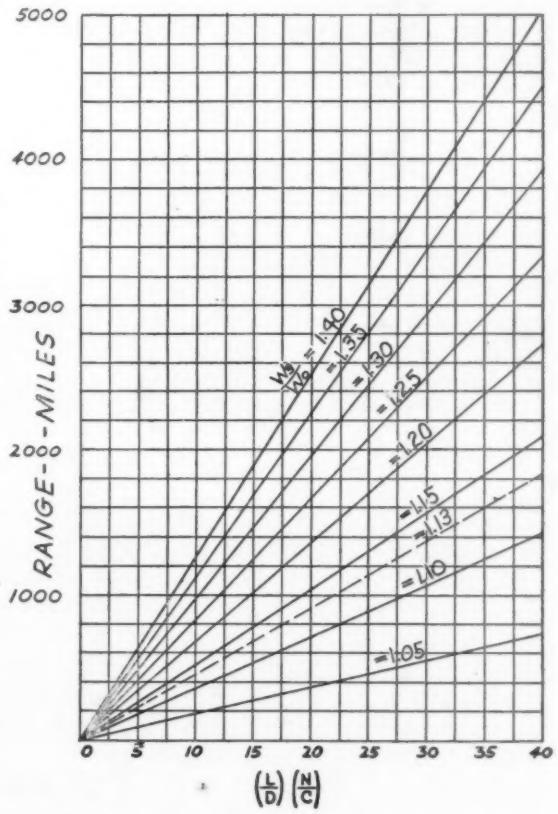
L/D for Class 3 = 10.00

(L/D) (n/c) = 10.00 x .80/.50 = 16.00

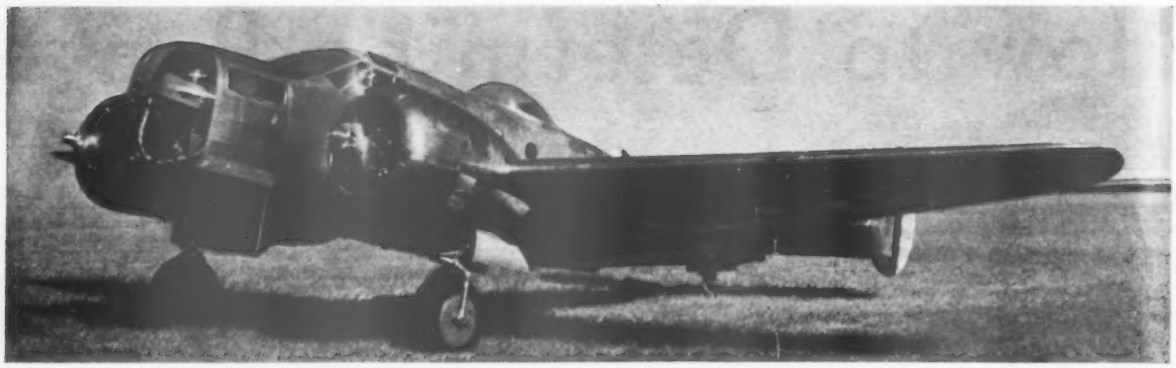
Reading on the chart as previously explained the range is found to be approximately 840 miles.

It is obvious that when the value of Wg/Wo is not represented, within the design range on the chart, by an exact curve on the chart a new curve must be found.

(*Continued on page 92*)

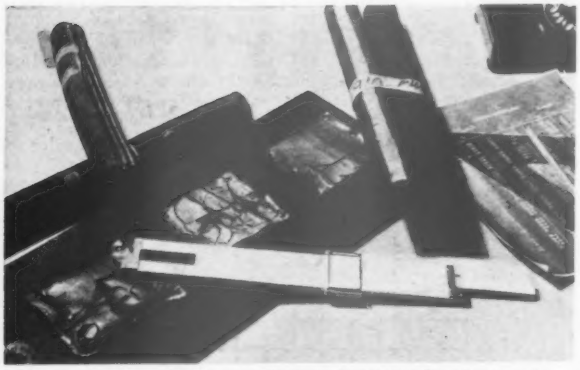


Graph, by the author, simplifies range determination.

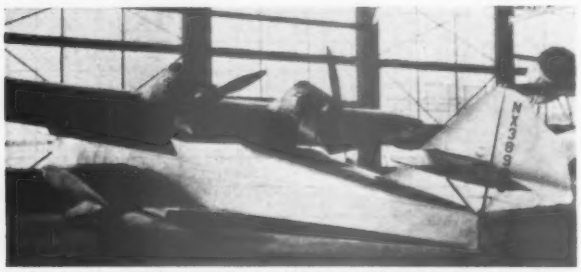


Developed for training bombardiers and gunner, this new Beechcraft AT-11 just has been delivered to the Army.

HAVE YOU SEEN?



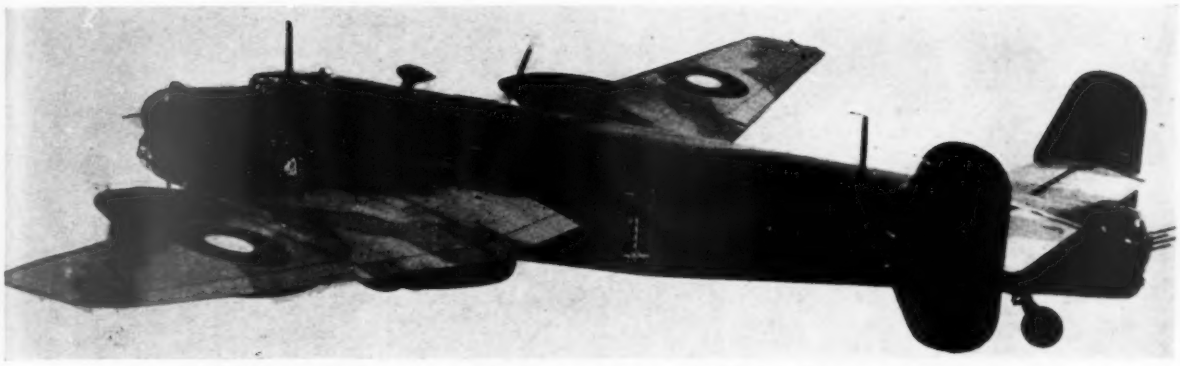
These aircraft materials recently were tested by Douglas in sub-zero cold. Rubber and leather cracked, an orange shattered.



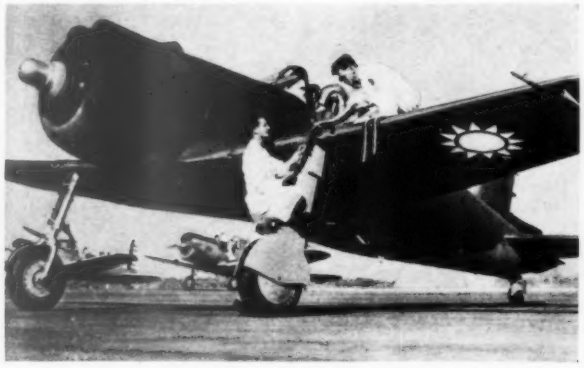
This novel amphibian, developed by New York firm, has two 65 h.p. Continentals. Wheels retract into the sponsons or "sea wings."

New RAF Hawker "Hurricane" is armed with 12 machine guns or four 20 mm. rapid-fire cannon (above). Old "Hurricane" had eight guns. Famed "Spitfire" already is using two 20 mm. guns.

Another lightplane to join the Army is this Piper YO-59. It carries pilot, observer and two-way radio.



British four-engined bomber now in production is Handley Page "Halifax." It has Rolls-Royce "Merlin" engines, 10 or 12 guns. Span is 99 ft., length 70 ft., height 22 ft. This is in Boeing B-17 category.

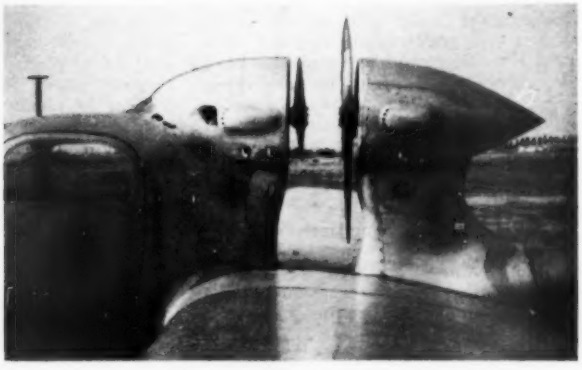


Now going to Chinese air force are Vultee "Vanguard" fighters. Engine is 1,200 h.p. "Wasp," top speed 350 m.p.h. It has six guns.

Navy SB2U's (below) now are being used by British Fleet Air Arm. Named Vought-Sikorsky "Chesapeake," pilots call it "Cheesecake."

Latest U. S. Army cargo transport is Curtiss C-46. Span is 108 ft., gross weight 40,000 lbs. Engines are two 1,700 h.p. "Cyclones."

The radical twin-engined experimental lightplane above was designed by A. C. Johnson of Long Beach, Cal. Two 80 h.p. engines are in tandem (below). Ship has tricycle gear, top speed is 135.



Stewardess classes are conducted by Miss Hazel Brooks (at right), American's chief instructress.

Stewardesses Wanted

by JACK DAY

Assistant Personnel Director, American Airlines

Appealing as this job is to the average young nurse, qualified stewardesses are hard to find.

THE hunt for the needle in a haystack is child's play compared to the problem facing an airline's personnel man searching for qualified stewardesses. In two and a half years on the job, I have toured almost every state in the Union, have interviewed over 2,000 registered nurses and, of that group, could select only 275 young ladies to fly as stewardesses.

Picking the "right" girls—ones who not only meet professional, physical and mental requirements but who also have that certain "sparkle" of personality—is a job that keeps one awake nights reviewing the names and faces of the hopefuls he has seen the day before.

How the stewardesses are selected and why certain qualifications are necessary is an interesting story:

Most applications come from registered nurses who believe they are qualified for the work. They have seen the bulletins circulated through a great many hospitals. These circulars outline the basic requirements: that one be a U.S. citizen, a registered nurse between 21 and 26 years of age, between 5 feet 2 inches tall and 5 feet 6 inches tall and weigh not more than 125 lbs.

Application blanks, mailed on request to registered nurses are returned, with photographs, to the airline's personnel office at La Guardia Field, Jackson Heights, N. Y. When several hundred applications have been filed, I make up my travel itinerary. Occasionally, applicants are invited to come to selected cities on the system for an interview. They are given space-available non-revenue passes for this purpose. The trip on the airline gives us an opportunity to judge their reactions to flying.

To help in selecting the best qualified Miss Ruth Anderson, herself a former stewardess and now in our personnel department, makes an advance trip through the territory I intend to visit. She selects the list of those who appear to be best suited.

Selecting a city which will be the geographical center for a large number of the applicants, personal interviews are arranged by mail. Sometimes as many as 30 or 40 would-be stewardesses appear.

The basic requirements eliminate many candidates. The registered nurse certificate is necessary, for experience has shown that girls with the hospital training in discipline, in organization work and in meeting the public make the best stewardesses.

The height and weight requirements are important, too. A girl must be tall enough to handle the duties of serving meals and making up berths. She must present a favorable appearance in the uniforms she will wear. At the same time her weight must be under 125 pounds, as every additional pound of crew weight means that much less revenue in passengers, air express or air mail.

The age limitation is some assurance to the airline that the stewardess will be able to work for several years before deciding on marriage.

The first few minutes are the most important part of an interview. When the candidate walks into the room, she creates the same impression she would on

This is a typical stewardess graduating class of 31 girls. New applicants constantly are being sought.

a great many persons who would meet her for the first time in the airliner. Does she walk gracefully? Is she proportioned as to her height? How does she seat herself in the chair. Does she slouch in the seat? Is she nervous? Does the initial nervousness disappear after some minutes of conversation? These are answered in the first minutes of casual conversation with the applicant.

If she does not appear to meet the requirements, she is tactfully advised of the fact. If the girl makes a pleasing appearance—she need not be a glamour girl—but a wholesome, healthy, attractive young lady, her professional background is requested.

From her formal application it is easy to learn the hospital at which she trained and something about her educational history.

There are other, just as important factors to be considered about her work in the hospital and her work as a nurse after graduation. How does she get along with the other nurses? What type of work in the hospital or in the nursing field does she like best? When and why did she decide that she would like to become a stewardess? Her answers to these give a definite indication into her possibilities.

The ability to get along with fellow workers is paramount in airline work. When one graduates from the stewardess training school, she will be based at various cities along the airline's route and will share apartments with other stewardesses. At these base cities a stewardess must be able to cooperate with her flight crews, passenger agents, fleet service men, as well as her supervisors in all phases of airline work.

Not only are her professional training and associations examined but also her pre-nursing education. Many of the applicants have attended colleges, some of them hold degrees from universities; the majority have gone from high school to nurses' training. Their outside activities are also guides to their employment possibilities.

Does she keep up on current events? What are her hobbies? How does she express herself? Does she appear to have poise? All these are determined through the interview.

Since a great many personages of national importance, military and Naval

Perfect health, a prime requisite for stewardesses, is sought by American's medical department. Dr. E. C. Greene examines an applicant. Nurse at left is ex-stewardess.

The author interviews a stewardess applicant. Hospitals throughout the country are regularly canvassed by Mr. Day and his staff, in the constant search for prospects.

officers, Government officials and defense production men travel by air, a stewardess must be able to recognize them and know their backgrounds. Frequently the people use the airline for the first time and the reception accorded to them by the stewardess makes a lasting impression. The stewardess must be able to explain airline transportation to the first rider in a way that is technically accurate and at the same time not confusing. What is most important, she must know when conversation is necessary and when the passenger desires to be left alone.

A girl who is flustered easily by an unexpected turn in conversation or events, is not a stewardess. She must be able to cope with any situation and to be able to do it gracefully.

Throughout the interview one tries to visualize how the girl will look in uniform. To make sure, applicants often are asked to try on the stewardess hat. The overseas type of hat is not the easiest in the world for a girl to wear to advantage. A change in coiffure to make the best appearance in uniform is sometimes requested.

At the conclusion of the interview, the applicant is told she will be notified by mail in a few days. As suitable applicants are found they are referred to Dudley Rice, American Airlines assistant supervisor of passenger service, with my recommendations. He makes the final selections.

When 20 or 25 girls have been selected —that is the usual number put through a training class—each is notified of her acceptance. When confirmation is received, Mr. Rice sends the young lady a space-available pass for her trip to the stewardess school.

The girls are advised to report to the airlines personnel department for further identification and thence to the company's physician who puts them through a strict physical examination. On passing the physical, prospective stewardesses are introduced to the personnel with whom they will be immediately associated. Miss Hazel Brooks is chief instructress of the stewardess training school and N. K. Wilson is supervisor of passenger service.

The seven weeks' training course includes instruction on the principles of aeronautics, radio, meteorology, airway traffic control, structure and maintenance of the airliners, preparation of food for serving aloft, ticketing and manifest procedures, company operating policies and the airline routes of the entire country.

At no time is the girl considered to be "in" as a stewardess until she has actually won her wings. Even then she continues on six month's probation.

Where do most of the girls come from? Records show that Illinois supplies 12 per cent, Massachusetts 11 per cent and Ohio about 10 per cent. Fifty-eight of American Airlines' 275 stewardesses are from below the Mason and Dixon line. All but four states—Delaware, Nevada, Oregon and Wyoming—are represented. Three are Canadian-born. One is from Scotland.

The average length of service for a stewardess on American Airlines is about two years, during which time her pay ranges from $110 to $130 a month. Maximum pay for a stewardess is $145 a month. Expenses, when the girls are away from their home bases, are paid by the company.

Search for new stewardess material is almost constant. Marriages take their toll from the ranks. Contrary to popular belief, it is not always airline personnel who win stewardesses for wives. Men whom stewardesses marry may be high school or college acquaintances, or just the boy next door. Marriages to passengers, whom girls have met while flying, are a rarity.

Good stewardess material is hard to find. Once a girl is accepted and trained for airline work, every effort is made to make her work pleasant and to see that she really enjoys her association with the airline.

Two weeks' vacation with pay, sick leave, group insurance plans, comfortable living surroundings at their bases, as well as at their overnight stops along the system, are part of the program to insure pleasant relationships.

Some stewardesses have liked their jobs so well that they have refused offers from industrial concerns, business corporations and other enterprises who use registered nurses. Quite a few American Airlines stewardesses have "Pioneer" pins for five years of service.

END

RCAF Heroes

FIRST members of the Royal Canadian Air Force to receive recognition for gallantry in Canada during the present war are Leading Aircraftman Cecil R. James and Leading Aircraftman Peter P. Conlin, stationed at Patricia Bay, B. C. The men have been awarded medals of the Order of the British Empire for risking their lives to rescue Lieutenant Bjornebye of the Royal Norwegian Naval Air Force.

Both Conlin and James maneuvered an 18-foot dinghy amidst flames surround the wreckage of an aircraft which had crashed near the Patricia Air Station, to rescue Lieutenant Bjornebye. The officer's companion was killed during the crash.

James is a native of Saskatchewan and Conlin was born in Hastings, England. The awards were made on the recommendation of Major C. G. Power, Minister of National Defense for Air in Canada.

Flying Battleship

GLENN L. MARTIN is about to test-fly the Navy's XPB2M-1, largest flying vessel in the world. The huge ship, whose keel was laid a year ago, is a long-range patrol-bomber capable of flying across the Atlantic and back again without stop. The flying boat is the Navy's sequel to the Army Air Corps' Douglas B-19 experimental bomber now undergoing flight tests at the Douglas plant and soon to be flown to Wright Field for further testing.

From tip to tip the wing measures 200 feet, 10 feet less than the Army's B-19. The two-deck hull measures 117 feet in length; its normal gross weight is 140,000 pounds; its power is four 2,000 h.p. Wright *Duplex Cyclone* engines.

The Martin boat is a full third larger than the largest Clippers now flying the oceans. At present the ship is undergoing strenuous stress tests at the Martin factory. When these tests have been completed, the structure will be moved to the new Martin "D" building, largest aircraft assembly floor in the world.

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Stop Japan Now!

(*Continued from page* 16)

Actually, Tokio is a military aviation officer's dream of pandemonium. An attack on water reservoirs and any of the baker's dozen major hydraulic and thermal generating plants will cause complete disruption. Fifty suburban electric interurban railways depend on several centrally-located electric power houses.

Rivers—narrow, shallow and rapid—are useless as supplemental navigation, when railways and bridges are blown up. A poorly equipped 200-mile-long street car system, using burdensome double trolleys, and trying to carry 3,000,000 Tokio passengers daily, will be paralyzed by the military expedient of wrecking suburban electric power plants. Also two million bicycles jam the narrow streets.

Tokio's suburbs, which have mushroomed thousands of armament factory smokestacks, can be decommissioned by enemy planes. Cutting water pipes connecting the reservoirs which feed the city's fire plugs, homes and industrial water tanks will create uncontrollable havoc.

Trains run on narrow gauge rails which—with curves, tunnels and mountains and allowing for landslides and earthquakes — reduce express trains to a 35 m.p.h average. The British-type small freight car, the size of an American caboose, transports freight at an average of 20 m.p.h. More freight cars move from sundown to dawn on the Norfolk & Western than shuttle in one week over any parallel Japanese trackage.

Much mileage is electrified—particularly the main line from Tokio to Nagoya (the center of aircraft production) — and industrial Osaka. Bombers will aim at the one main line and at transformers and transmission lines which web Japan like neon signs on Broadway. Four railroad lines lead from Tokio. The main line — the Tokido — winds through 20 tunnels (the longest is five miles) to the end of the islands, 700 miles away. Twenty passenger trains run every 24 hours, taking 20 hours each. Imagine the composite facilities of New York City limited to a double track to Chicago, over one major railroad bridge a third the size and quality construction of the George Washington over the Hudson! North from Tokio, two lines carry traffic 400 miles over plains and through mountains. Through the backdoor of Tokio is another railway penetrating a mountain chain. A flight of bombers will find, in one glance, three vehicular bridges and approaches of the mile-wide Shinagawa River south of Tokio—the Empire's sole traffic arteries connecting highly industrialized sections of Yokohama where automobile, rubber, chemical and electric manufacturing plants stand in open, reclaimed land.

Bombers over Osaka will intercept the flow from the Yodogawa reservoir, set fire to giant cotton and rayon-spinning mills, wartime chemical plants and industrial alcohol units. Japan's war productivity centers at Osaka, 50 miles closer to Vladivostok than Tokio.

Westward 250 miles is the arsenal terminal of Japan, the coal mine center—unprotected by mountain ranges—concentrated near the seacoast 600 miles from Vladivostok and bordering the Pacific. A combined air attack from the north and carriers from the south could practically disable the region in one trip.

Imagine the huge Ford River Rouge industries—the equivalent in size of Japan's arsenal industrial acreage of coal, water, electricity and ore rations—coupled with a shortage of skilled labor, and you have a picture of the midget proportions of Japan's wartime effort. Remember; it is contrasted with *one* American company at Dearborn, Mich., which produces more and better than the combined assembly lines of all Japan.

One effective attack from an American aircraft carrier, bombers from Siberia, or a squadron from China could cripple Japan's transportation system. Night attacks on any part of Japan will leave her practically helpless. If bad weather prevails they will not be able to patrol the island and return to any base, due to the limitation of their flying fields. One open spot in Japan could be a focus point to navigate and bomb with considerable success, due to the small area and the cities being so closely adjacent to each other. In other words, it will almost permit her enemies to do blind bombing and still be very effective.

Important naval bases also will be vulnerable to bombardment, in view of the fact that antiaircraft defense cannot function until the attacking forces are over their objectives. Such airports as Japan has could be bombed completely out of commission, as they have few such bases and cannot move freely to newer fields, due to the condition of the terrain.

Then the Japanese are not up to par with other countries in night and blind flying operations. They have been lax in this phase of aviation; only in the last few years have they installed night-flying equipment on certain air routes.

"Sorry, buddy, I got on the wrong beam."

American military and Naval aircraft could protect themselves easily against any pursuit action of present-day Japanese airplanes.

All of this will leave Japan in a precarious position if organized aerial warfare is made from Siberia, China, Alaska and from carriers in the Pacific.

The island of Japan — being limited in size and its major cities and industries located so close together on the shoreline —does not permit them to locate antiaircraft defenses sufficiently distant from those cities to endanger an approach by enemy aircraft. Even if their antiaircraft defense is effective, the enemy will have already reached his objective before the Japanese can attack.

The concentrated effect of an American and Soviet bombardment of Japanese rail heads will seriously handicap Japan; they have not yet developed main highways between their major cities. Where they have done so, they have made only single roads. All shipbuilding industries are located in the main ports; Japanese naval bases and shipyards are extremely vulnerable because of the lack of antiaircraft defense.

Primarily Japan's geographic condition is not favorable to the development of aviation. The country is small and population centers are comparatively close together. It is very mountainous and this, coupled with the fact that rice fields cover most of the level country, makes emergency landing places extremely scarce.

Weather conditions in Japan—particularly in winter—are a major obstacle. Because of the few airports, heavy snows would handicap them in sending up aircraft to fight off bombardment. Any formation of airplanes attacking Japan, car-

(*Continued on page* 62)

"A feeling and sense of security unparalleled in our flying experience . . ."

The Brayton Flying Service, Inc., Lambert Field, St. Louis, is using two Waco UPF-7 planes for their secondary pilot training.

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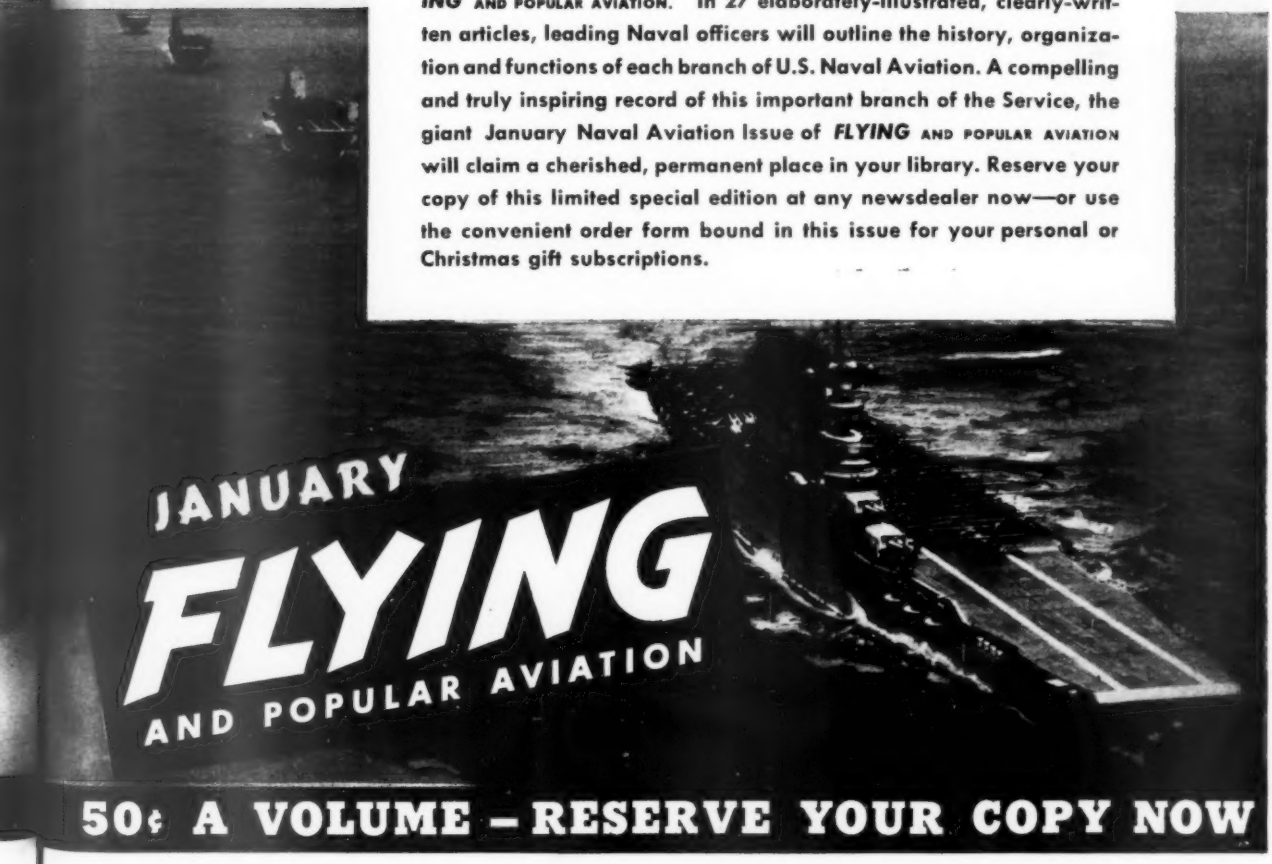

JANUARY

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rying only a small number of incendiary bombs, will be so effective over the helpless country that they will be able to carry all the gasoline necessary to permit long-range operation. Weather conditions are such that the center of Japan, when completely overcast, will permit enemy aircraft to take off from distant places, attack in comparative safety and return to their bases while Japanese defensive aviation remains grounded.

Particularly notable is the fact that the roads are so narrow from even the largest factories to their airports, they must assemble their airplanes at the field instead of in the factory. Almost all of their fields are natural turf and little effort has been made to install good runways for operations during heavy rains.

Notwithstanding Japan's recent reorganization of her army and navy air forces, with Gen. Kenji Doihara (described many times as the Japanese Lawrence of Asia) as head of the air arm—Japan's present air power and material strength are no match for our modern bombers and 400 m.p.h. fighters.

Production of planes in Japan is variously estimated. The generally accepted figure is 250 a month. Their plan was to increase the output in 1942 to 360 planes. But the lack of essential materials cuts their production figure from a normal 250 to about 150 per month. Lack of materials and worn and overworked American precision tools have slowed the aviation industry.

But, most important, she is totally deficient in every essential war material — iron and steel, aluminum, modern machine tools, copper, cotton, tin, wool, scrap, oil and gasoline, lead and manganese. Her war machine at home—which might be called her fourth front — would be paralyzed. She has no reserve material, is economically exhausted, financially ruined and paralyzed from America's freezing order.

In aviation, as in the auto industry, the Japanese have always had something of everything from everywhere. A big handicap is the development of carburetors to contend with notoriously bad Japanese weather conditions. They have French carburetors, American piston rings, German and Italian cylinder heads, Swedish ball bearings and all kinds of machine tools — plus American cotton, Dutch rubber and imported aluminum.

One cannot estimate Japan's accumulated stocks and reserves, but in a searching, conservative analysis — and having observed the world's greatest armament producing power—I believe it is suicide for Japan to start a shooting match with any organized force.

Principal Japanese aircraft factories are located in Tokio and Nagoya. The largest engine factories are centered in Tokio. One of the strongest points regarding the vulnerability of Japan from air attack is the fact that all of the large industrial cities which contain factories are adjacent to the seacoast. They have no way of defending these cities from air attack. In Europe, antiaircraft defenses are not only located within the cities themselves, but many miles away and in the logical path of approaching aircraft. But Japan cannot have such defenses because it will be practically impossible to organize sufficient antiaircraft defense on boats to strike at enemy aircraft before they arrive at their objectives.

Japanese manufacturing industries are operated for the national defense and all companies are closely supervised by the Army and Navy. There are eight large aircraft companies in Japan. Largest is the Mitsubishi Aircraft Works, which produces pursuit and bombardment airplanes, engines, propellers and aircraft accessories. Nakajima Aircraft Company is another major producer. The Kawanishi Aircraft Company manufactures seaplanes. The Aichi Aircraft Company, Showa Aircraft Company and Tokio Gas & Electric Manufacturing Company also are among the Big Six.

"Joe, the fire chief, suggested it. It's the only way we can get the darned ship to turn."

For a number of years the Japanese have developed aircraft through adapting a type purchased through a manufacturing license from some other country. These licenses and designs have become obsolete by the time they have gone into production. However, all of this has been an educational factor with them and they recently endeavored to design their own airplanes, particularly fighters. They have had some success, but these airplanes are limited in range and usually have excessive landing speeds, necessitating almost perfect ground facilities. They are far behind with regard to the development of armor plate and bullet proof gas tanks.

Their bombers are a combination of various adaptations from German Junkers and Heinkel types. The majority of Japanese engines are of foreign design and low horsepower. It has taken them considerable time to tool up to producing these engines, as well as airplanes, and today are more handicapped than ever in their attempt to change their tooling for the manufacture of newer types of airplanes and engines recently obtained from Germany.

Their aviation factories do not compare with European or American plants. They still use a great deal of hand work. It is true that they have been successful in building large steamships, but that industry has been educated for a long time in the development of freighters and large passenger-carrying vessels under foreign supervision. The aircraft industry, however, has only recently been developed and the Japanese have encountered many difficulties in the development of forgings and castings. Japanese castings, for instance, are far below U. S. standards. As a result, they have many casualties from airplane accidents caused by engine failures.

Japan's air force is believed to total 5,000 planes. Several hundred, or as many as a thousand, are perpetually grounded for repairs, because they cannot now import spare parts. They do not have materials, patterns or the metallurgical ability to make parts. Of the 5,000 planes, 3,000 are navy and 2,000 army. The total first-line fighting planes in their army and navy is about 3,000, including about 1,000 trainers. The remainder are transports and other types. Distribution of Japanese army and navy planes places approximately 400 in Manchuria, 700 in North and Central China and 300 in South and Indo-China. With all their aircraft planning, however, they are frightened at news of the United States' program. They look eastward and worry about our two-ocean, $10,000,000 Navy of 338 large and small warships and 400,000 skilled men. With our expanded fleet including 12 aircraft carriers, 15 battleships, 54 cruisers, 197 destroyers and 74 submarines—thereby increasing our fighting ships from 338 to 691—our Navy will have tonnage which Japan cannot hope to equal. Also we have a Navy training program of 6,000 pilots to be attained by the end of December. Again, the Japanese have noted with worried brows that our expanded air force will include 17,000 men. As the Japanese look south they find that, almost overnight, we have joined with the British and the Dutch to treble our reinforcements in the Pacific.

Military aviation in Japan had its beginning in 1911. Two young army officers had been sent to France in 1909 to study aeronautics. Returning home, they formed the nucleus of an observation unit. The effectiveness of the airplane as an offensive weapon was brought to the attention of Japan's high command when a mission of 22 officers and 70 mechanics visited Italy in 1918 and returned with eye-witness accounts of air battles over the various World War fronts.

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The following year, a group of 60 French army aviators was invited to Tokio to give instruction to Japanese army aviators.

The first Japanese aviation school opened near Tokio in 1920, with an enrollment of about 100 commissioned and non-commissioned officers. Two other schools were established in 1922 and aviation was added to the curriculum of the Imperial Military Academy 15 years ago. Improved machines were purchased from abroad and government and private factories then began manufacturing by copying them in fairly large quantities. An independent army air corps was established in 1925; thereafter, the Japanese kept up an expansion program of building air units from company to battalion to regiment.

The aviation department of the Japanese Military Academy became an independent institution known as the Military Aviation School, with its own airport and workshops. The school specialized in developing strategy in combat. Original ideas and technique, peculiar to the Japanese, were experimented with. However, they have not been successful in creating individual tactics and individual ingenuity; the inability of a Japanese to disengage himself from group thinking in an emergency largely has been responsible. In other words, the military academy could not make them into individuals. It, therefore, reverted to mass performance and group thinking. Consequently, like the Italians, they are lost without their leader.

When the Sino-Japanese "incident," as they call it, broke in July, 1937, the air arm of Japan's military comprised 10 regiments including 11 reconnoitering, 11 fighting and four bombing companies, with two balloon corps. German-trained parachutists were adopted only two years ago; their first landing in China was reported in October, 1941, when a Japanese paratroop detachment was killed or driven away by the Chinese and Chuchow. This, however, may be an indication of preparation for an invasion of the Philippines.

Expansion by conscription of flyers has been part of the Japanese program at numerous new schools. The first had an enrollment of 400 five years ago and now is training men by the thousands. But Japan never will equal American airmen in quality or quantity, mainly because of inherent physical handicaps.

Japanese pilots have no fear. In temperament and psychology, the Japanese are like the Germans; they have a fanatic and religious devotion to their leader and they believe their bombing missions are holy acts of a manifest destiny. They will deliberately crash themselves into an objective. In such suicide attacks they plunge with the thought that their spirits will be enshrined in the temple of Imperial worship.

Japan's best pilots are in the navy. This may be due to the fact that many of them have been trained abroad and the physical and the educational requirements bring a higher type than to the army, but in either branch of the service they are not natural flyers any more than are the Chinese. They cannot adapt themselves from a life of work in the rice fields to flying in the air. There is an instability in their functioning and their reflexes simply do not correlate under pressure at great altitudes.

Nor can they get away from book learning. The Japanese think and operate in groups. They memorize mechanical equipment, but do not take to it naturally. In military tactics they are all right as long as everything is going according to the book, but when they encounter a discrepancy or problem, and they have arrived at the last page of the manual, they are lost.

Most Japanese youths come from the country where, despite a government campaign, mothers still carry children on their backs. This handicaps Japanese pilots with eye trouble since the head, from infancy, is held with the eyes skyward.

Lack of blind flying training, as I have pointed out, is a major handicap. As the terrain in Japan does not permit many emergency landings, they would lose many planes in wartime through lack of blind flying ability. American and European aviation experts who have been in Japan, and who have been stationed as exchange officers with Japanese air regiments, have noted in particular that, while they can fly almost any type of airplane—providing everything functions normally—they have extremely limited knowledge of the mechanical operation of their equipment with respect to limitations and safety factors. The percentage of pilots who could be considered first class is extremely small and consists mostly of men who have been fortunate enough to get by for a number of years and who have acquired a fairly good knowledge of the points necessary to make a good flyer. The younger conscripts are extremely inefficient. Considerable question is raised by competent observers as to Japanese ability to handle armament. In addition to bad marksmanship, they do not seem able to coordinate speeds.

Their ability to land airplanes runs from one extreme to another. They either land far in excess of the speed required, or they make stall landings. This is due to their lack of knowledge of the speed limitations required for landing. They never seem to hit a happy medium and in no way do they appear to have a

(*Continued on page* 100)

A Japanese "Secret"

The Japanese always are buying the latest inventions—to copy. They purchased an American passenger job years ago. An American engineer brought the plane to Japan to make delivery. As soon as it was unloaded, the plane became the property of the Japanese army and automatically became a national secret. Not even the American salesman was allowed thereafter to see his plane.

One purpose in sending him to Japan was to demonstrate the ship. The plane was the largest the Japanese had ever seen. The gadgets simply had them dizzy but, typical of Japanese psychology, they figured they would learn fast, copy at once and the sky soon would roar with the great winged production from America. The American insisted that he show them how to take off and land. "No," he was told, "this plane is a secret."

So he left for San Francisco—but was not half way across the Pacific when he received a wireless message advising him that the $250,000 plane was half in the water and half on the ground at the Haneda airport, outside Tokio. The secretive Japanese had attempted to bring her down on their first test flight and had landed on the edge of a concrete pier.

They bought another plane.

FIGHTER TRAINER

IT looks like a fighter, but is a trainer. However, the Navy's new Curtiss SNC-1 is an advanced trainer designed primarily for fledgling fighter pilots. When announced recently by the Curtiss company, the SNC-1 already had been tested, accepted and ordered in quantity by the Navy. Based on the original CW-23 design, the SNC-1 is a two-place, all-metal monoplane powered with a Wright *Whirlwind* engine. Already in use, SNC-1's performance data are withheld.

"WHEN IT COMES TO PLANES . . .

I Take My Cue From You!"

EVER notice how many of Uncle Sam's "war birds" fly Aeroncas when they're off duty or on leave? They want a plane that's "disciplined"—a plane that responds instantly to stick or throttle—and every Aeronca meets that demand 100%. They're particularly keen on the new 1942 Aeronca "Defender" Trainer. Some of them, no doubt, have had a chance to fly the YO-58—sister ship of the "Defender"—which is now being service tested by the U. S. Army Air Corps.

So, take *your* cue from the boys who know their planes . . . fly Aeronca! See your nearest Aeronca dealer today . . . ask for a FREE flight demonstration in the "Defender." Ask him, too, about his FREE flight instruction plan. Discover for yourself why all America is choosing this low-cost, easy-to-fly, easy-to-buy Aeronca.

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Win a new Aeronca "Defender" airplane, or one of many other valuable prizes. See your local Aeronca dealer or write Aeronca, today, for complete contest details.

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'Cooked' Craft

(*Continued from page 23*)

cheap. Nor is skilled labor required. Carpenters and wood workers fill the bill. Green labor can be trained in two weeks. Regular wood-working tools are the only machinery required.

The Langley corporation had the Air Corps in mind as a purchaser of bi-motored trainers when the idea was put to test. How well they succeeded in avoiding the use of metals is indicated by their ship's scant 160 lbs. of metal out of an empty weight of 1,410 lbs. This includes landing wheel forks, fuel tanks, and engine mounts.

Ironically, the corporation almost fell into the priorities trap—despite wood construction. The OPM had recommended the use of plastic plywood to save precious aluminum and then proceeded to clamp on the plastics themselves by placing them on priority. But construction of the Langley requires a particular type of plastic bonding agent that so far has escaped the priorities gauntlet.

The fuselage is molded in three sections: the nose, and two half fuselage shells. It is split along the top and bottom centerlines. Its ideal feature is that the wood mold can be recessed to take the nine bulkheads and the few longitudinal stiffeners required at the window and door cutouts. Toward the rear the reduced fuselage size causes more abrupt bends and consequently more plies are required than about the cabin. No mechanical fastenings are needed except in major assemblies. No bolts, nuts, or screws. Windows and door are sawed out, after the two molded fuselage halves have been joined.

The fuselage bottom is contoured to fit the top surface of the center section of the wing which is attached to the fuselage by eight long bolts, in four groups of two each, running up from the front and rear spars to the two substantial fuselage formers just above. The stabilizer is similarly bolted to formers at the rear of the fuselage.

The simplicity of plastic plywood construction reduces maintenance and service costs. Inspection is facilitated. The quickly detachable molded cowlings are asbestos lined and, although a stainless steel firewall is used, actual tests with a blow torch show that plastic plywood and stainless steel of the same weight require respectively 20 and two seconds to burn through. Plastic plywood is an ideal fire retarder.

The Langley company does its "cooking" in a made-over boat house at Port Washington, Long Island, where a skeleton force of 20 men are employed. The process is intriguing. First, skilled wood workers construct accurate molds. Layer after layer of thin, plastic-treated veneer strips are formed over the molds, each succeeding layer being cross-grained to the one beneath. Various thicknesses of veneer and number of layers are used for different parts. For example, some of the bulkheads have as many as eighty plies, some of which are as thin as 1/64 of an inch. Small radius bends, as little as one inch, are encompassed by a number of extremely thin plies topped, as the total thickness builds up to a greater radius, with progressively thicker plies. An uneven number of plies must be used or warping results.

"This is the latest thing up here . . ."

Actual "cooking" or "baking" is done in an autoclave, a rubber-curing tank or chamber. The part to be cooked is covered with a canvas sheet and placed in a protective air-tight rubber bag, from which the air is exhausted before the part is placed in the autoclave. Heat and pressure are needed. Since steam at any given temperature exerts a definite pressure, it is a simple trick to admit steam at the necessary temperature into the chamber. The pressure is automatic and is controllable by varying the temperature of the steam. The exact temperature used is a trade secret. From 30 minutes to two hours are required for the "cooking", depending on the thickness of the material. A similar period is needed for cooling. By spraying cold water into the tank and simultaneously pumping in compressed air to hold the pressure when the steam is shut off, permanent setting of the plastic takes place as the temperature drops.

Langley uses a thermoplastic bonding agent. Thermoplastics are set when hot and can be reheated and softened as many times as desired. Fairchild uses a thermoset in the Duramold process. Thermosets are set either hot or cold. Once heated thermosets become permanently fixed and cannot be softened again by subsequent reheatings as can thermoplastics. Langley prefers thermoplastics because they work 100 per cent of the time. Langley claims thermosets do not always work properly in its product. Cold-setting thermosets are ideal for final assembly of the halves of each of the vertical tails.

The basic idea is known as the Vidal process. Remember the $700 lightplane bubble during Eugene Vidal's term as director of the old Bureau of Air Commerce? Langley may set a new low in production prices for airplanes of this type, indicating that Vidal was on the right track.

The finished airplane is painted like a fine piece of furniture. Plywood surfaces first are given a filler coat, then stained mahogany. Many top coats of varnish are needed. Each coat is followed by a thorough sanding. The result is a sleek surfaced airplane. This very smoothness means higher performance. Skin friction is cut to the bone. The plywood-covered wing is 15 per cent more efficient than one covered with fabric and three per cent better than an all-metal wing.

According to Jensen the Langley's wing picks up its superior performance because it is free from any rippling. For a fully cantilever design, the choice of a Clark Y airfoil results in an unusually thin wing. Depth at root is only 11.1 per cent of the chord. Yet the use of two sturdy spars and plastic plywood skin enables the Langley to meet CAA requirements.

The technique in constructing the wing is ingeniously simple. Against the front and rear edges of the main wing mold are placed two I-beam spars. Solid plywood ribs are then dropped into the mold's slots. Special recesses, cut in the top of the mold, take the cap strips over the edge of each rib. Spars are made from two molded U-shaped channels set back-to-back forming the web of the I-beam. Top and bottom flanges of the I are mahogany laminations. A heavy sheet of plywood is bent over the mold. All parts, naturally, have first been treated with the plastic. "Cooking" welds the plywood parts into one rigid unit. When the wing is lifted from the mold it is inverted and the bottom surface is put on.

Other features enhance the Langley. For example, multiple compression rubber discs are substituted for oleo shock

(*Continued on page 96*)

YO-57
U.S. ARMY AIR CORPS

TAYLORCRAFT YO-57
Official Photograph, U. S. Army Air Corps

"GRASSHOPPERS"—that's the name soldiers dubbed light planes which participated with ground forces in the Army field maneuvers of the past Summer. But, to the Army Air Corps, it's now YO-57s—the official designation for Taylorcrafts recently purchased for further tests as the result of the favorable showing made by the "Grasshopper Squadron".

Under the grueling tests of the Army maneuvers, these planes were required to fly from very small fields and rough terrain in Texas, from cow pastures and roadways in Louisiana, meeting whatever ground conditions existed adjacent to Army Field Headquarters.

Short range reconnaissance and liaison work, carrying messages, and reporting troop movements by means of two way radio equipment are operations for which the suitability of the Taylorcraft YO-57 is being determined.

Purchased "off the shelf" by the Army Air Corps, these YO-57s, except for camouflage finish and very minor additions in equipment, are identical to the Taylorcraft Tandem Trainer being supplied to civilian operators for civilian pilot training and civil defense service.

Your Taylorcraft dealer will gladly demonstrate the superior performance characteristics and show you the modern operating and comfort advantages of Taylorcraft airplanes. See him, today!

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DELUXE • SIDE-BY-SIDE TRAINER • TANDEM TRAINER

Our Warplanes Are Best

(*Continued from page* 34)

take-off other ships were grounded. The Martins got through without mishap.

One pilot landed his bomber on a golf course near London, Ky. He landed the alleged killer on a fairway that was both uphill and at an angle to the course's level. The only damage was to the nose wheel which rammed into a bunker. None of the crew of four was injured even slightly. A second pilot landed at the Lexington airport, which is far from being a large field. He refueled and flew on to Patterson Field reporting that the ship handled perfectly both in landing and taking off "even on the short field." The third pilot tried to outride the storm and went above it. Flying on instruments, he was carried off his course by a strong crosswind but finally found an opening in the weather and came through, located his position, proceeding to Patterson Field without incident—except for the fact that he landed with only a few drops of gasoline left in the tanks.

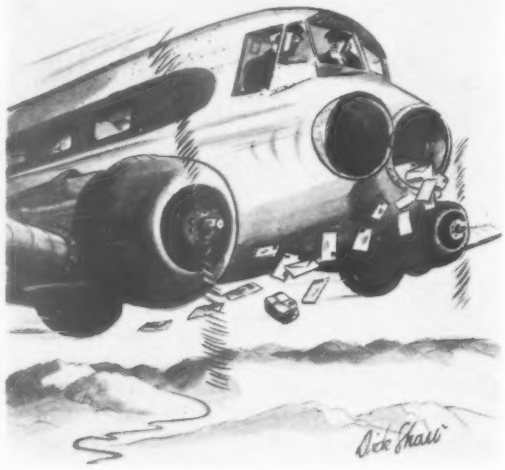
Here, then, were actual situations where B-26's proved they can land on emergency fields equivalent to even wartime airdromes. The B-26's can take it, too. The same pilot who landed on the golf course several days later had an engine go dead while flying a Martin on a routine test flight over Ohio. He landed the ship in a small cornfield without injury to himself or his co-pilot. The plane was smashed up, but it proved to be structurally strong enough to take a severe beating in a crash landing.

Regular squadron pilots flying the B-26 have reported favorable results with the airplane. There have been minor criticisms—such as accessibility into the cockpit, window ventilation, egress, installation of non-skid tires, flap adjustment—which pilots have made but, on the whole, everyone seems well pleased with the ship. All recommended changes are being made in production models as quickly as possible. Later models of the B-26 will have a slightly larger wing. This is *not* being done because the present airplane is dangerous, but because we intend to carry still more guns, more bombs or more gasoline to increase the range of operations. Representatives of the Martin company, and all other companies making engines, propellers and other accessories for the B-26, are at Patterson Field during accelerated tests. They telephone recommended changes to their plant engineers, who immediately get to work on the problem, making corrections in the planes on the assembly line. If some models get through without the changes, these are later called back to the factory or sent to Patterson Field where they are brought up to date.

To date there has been only one serious fatality with the Martin, according to our records. That was a crash during a take-off at Baltimore on a test flight. An engine failure was to blame. But on any plane, no matter how well-proved its design is, an engine failure on take-off is a serious thing which may easily result in a fatality.

Fifteen of the B-26's were sent from Patterson Field to the recent maneuvers in the south and were operated under simulated war conditions. Both Lieut. Gen. H. H. Arnold, chief of our Air Forces, and Assistant Secretary of War for Air Robert A. Lovett, have expressed satisfaction at the ships' performances.

In a report to his commanding officer a young lieutenant connected with accelerated tests, when asked what he thought of the B-26 bomber, wrote: "There is nothing too fast about the plane when it lands. The ship just wasn't built for old women to fly, that's all."



"Do you feel a breeze?"

Another plane which has been the subject of criticism is the North American B-25 bomber. There has been very little trouble with it, except for minor difficulties that occurred at the factory during test flights and some difficulty with nose wheel operation at one of the Army's west coast fields, where a commanding officer grounded all the ships until the trouble was remedied.

At first, pilots in landing the B-25's were having trouble with the nose wheel gear not locking properly. This was discovered to be primarily a fault in the original construction. On first models the locking collar was so designed that it could be installed in two ways and mechanics had difficulty in getting it on correctly, consequently there resulted a few cases of bad landings, but no fatalities either to pilot or plane. If this collar was installed the wrong way the nose wheel sometimes, when extended, was at a slight angle to, instead of being exactly in line with, the fuselage. The first time this happened it was feared that the landing shock might snap the nose wheel shaft and result in serious damage to the airplane and a good chance of injury to the crew. We had several cases in which pilots landed the planes with the nose wheel at an angle, but always when contact was made with the ground, the motion of the plane straightened out the wheel and resulted in nothing out of the ordinary. North American engineers have entirely eliminated this defect.

One bombardment group has been flying the B-25 under gruelling service tests for 437 hours of night flying at this writing. The ships have been landed in small fields and large ones, on grass fields and on concrete runways. In no cases have there been any serious difficulties in landing by day or by night.

In regards to the light attack bomber, the Douglas A-20A, this ship is one of the sweetest flying planes ever put into service. Our pilots will tell you that they would rather by far operate an A-20A from small fields than one of our old obsolete B-18's.

The Douglas A-20A was a development from the DB-7 bombers which were originally designed and built for the French. The A-20A, or redesigned DB-7 incorporated more powerful engines and quite different armament and bomb load arrangements. In this redesign it was necessary to change not only the fuselage but the wings, tail surfaces and landing gear.

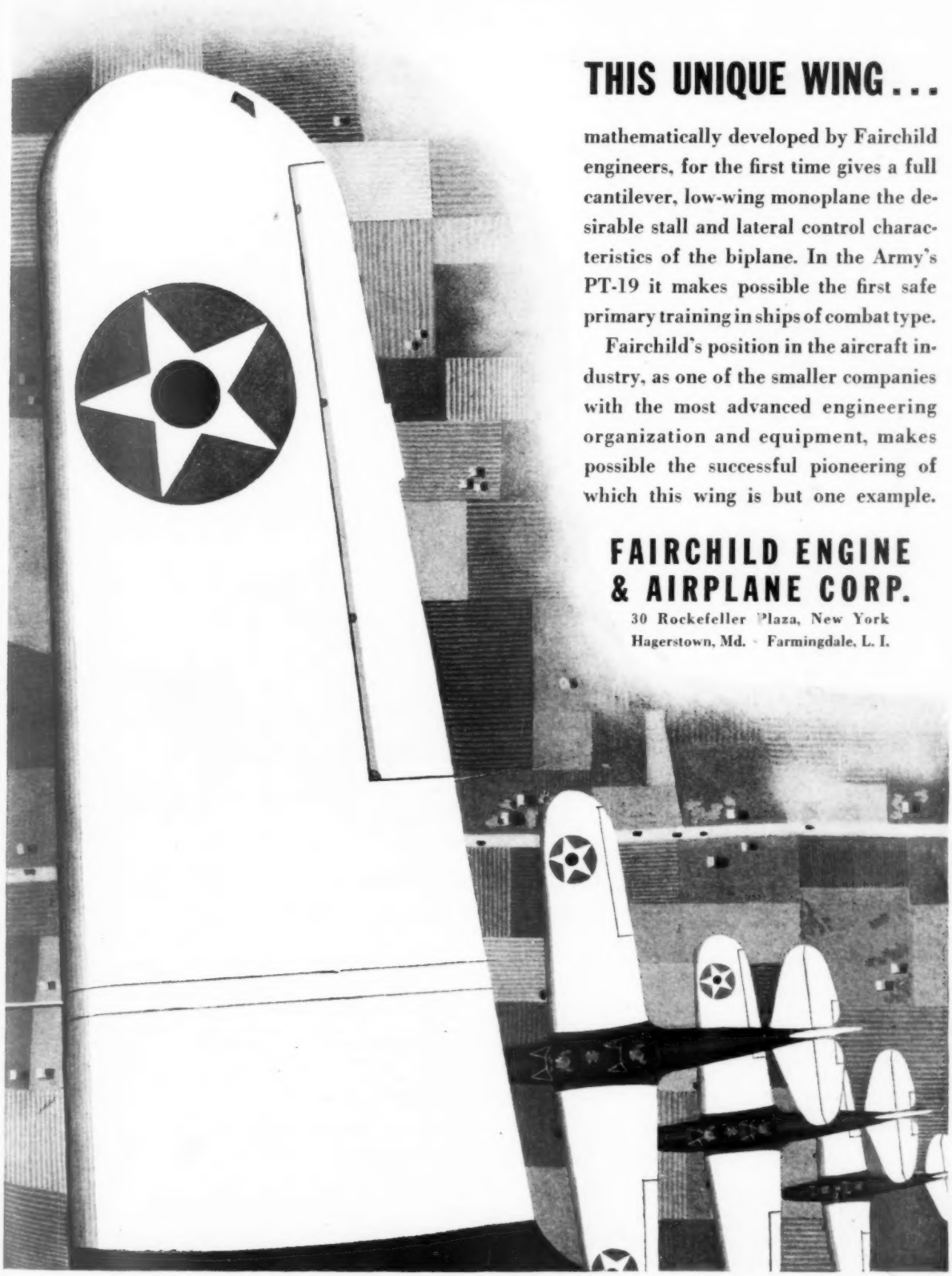
When France capitulated, the DB-7's on order were taken over by the British, who christened them *Bostons*. Immediately the British wanted to replace the original 1,200 h.p. engines with 1,600 h.p. engines. They added more machine guns and armor. The result was the same airplane as the A-20A, and large quantities were ordered by the British and renamed *Havocs*.

Additional power gave the ships added weight, but increased the planes' speed and rate of climb. This factor together with the ease of making night landings foolproof with the tricycle landing gear, has led the British to adopt the *Havocs* as night fighters, installing as many as 12 guns in the nose of the ships.

One pilot, after a mission with a Douglas A-20A, landed at Wright Field and told a young pursuit pilot: "You give me two minutes start and I'll run your plane out of gas before you catch up with this ship." This is possible at altitudes below 15,000 feet with most of our twin-engined bombers.

With regard to our heavy bombardment airplanes such as the Boeing B-17's and the Consolidated B-24's, these ships speak for themselves. We have never

(*Continued on page* 96)



THIS UNIQUE WING . . .

mathematically developed by Fairchild engineers, for the first time gives a full cantilever, low-wing monoplane the desirable stall and lateral control characteristics of the biplane. In the Army's PT-19 it makes possible the first safe primary training in ships of combat type.

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The Netherlands Indies Are Ready

(*Continued from page 20*)

ditional bombers also will be flown to the islands by way of Honolulu. The route they will take after leaving Hawaii is a secret, of course.

But we need bombers and more bombers. Fighters are useful for local defense, but patrolling a ragged coastline for a distance equal to that from New York to San Francisco requires medium-size long-distance bombing and patrol aircraft. Our islands present one happy circumstance. The greatest over-water distance between landing bases is about 400 miles, an easy flight for our Brewster pursuits or our reconnaissance ships. They could be in the air and on their way to a point of threatened attack anywhere in a matter of minutes.

There is little chance that an aggressor could surprise us. Day and night, over every mile of the coast, our plane patrol is on the alert. In many places our patrol overlaps that of Australian seagoing costal planes, the British out of Singapore and Americans from the Philippines. Their cooperation is perfect.

The Indies' armed forces are completely independent and the defense plans are geared to meet any eventuality—even the possibility that Singapore, greatest stronghold in the Far East, should fall. Singapore, however, now is almost impregnable from either a land or sea attack.

Most observers believe our two chief oil ports, Balikpapan and Tarakan on the eastern coast of Borneo, would bear the brunt of an invasion thrust. It would be the task of our bombers to stop an aggressor who attempted such an attack, or at least to prevent the enemy from establishing a base for an attack on Java, our most strongly defended island. Of course, there are fixed garrisons with planes on all other principal islands.

In the last year or so we have established landing bases all over the Indies. Our flyers know where they are, but they can hardly be seen from the air. Aviation gas and oil is secreted at all bases, making it possible for planes to remain away from their main bases a long time.

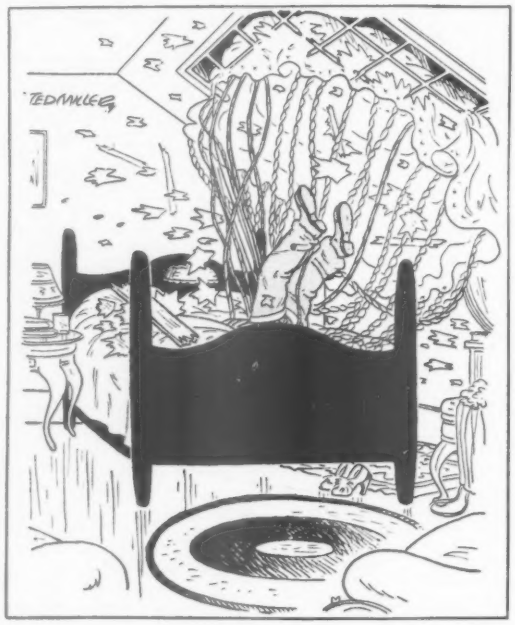
When I named our Army Air Force planes—the striking arm of East Indies defense—I purposely omitted our Martin bombers. We count on them heavily as being able to out-fly and out-shoot anything the enemy can put in the air and they have a range of 2,000 miles with heavy bomb load.

If an enemy might come, we will have another advantage in the air—they will have to use a large number of carrier-based fighting ships, notoriously slower and less effective than our Brewsters and Curtisses which will meet them.

Our pilots are among the best-trained and most efficient fighting men in the world, young Dutchmen between 18 and 27 who have the best fighting hearts I have ever seen. An incident that will give you an idea of how they want to fight is this:

We have enough pilots so that now and then we can send some to England to fight the Nazis with the RAF. Two groups have already gone half way around the world to get there. One day we called for five men from a squadron of 100. Every single man in the unit, as well as the squadron commander, volunteered. We chose five of the best and they now are fighting the Nazis.

The East Indies army air arm is making experiments with native flyers for the first time and we have several who compare favorably with the best European air men. On July 1 we started 25 more, mostly Javanese, in our primary training school. The percentage of natives who will become first-line pilots is smaller than among Europeans but a great many will graduate as officers.



"Pardon me, lady, I'm one of the paratroops on maneuvers."

In the Army proper, 85 per cent are natives. There are no distinctions, no discrimination in our armed forces. Natives can become officers to command units of mixed Dutch and natives. This is understandable when you consider that, out of our Indies population of about 70,000,000 on between 2,000 and 3,000 islands, there are 300,000 whites, 1,500,000 Chinese and 67,000,000 natives—Javanese and Malays and about 100 other races. And they speak 200 different languages. Many of them make first class warriors, in the air, on the ground or at sea. The army air arm has a cadet school at Bandoeng, and the Dutch East Indies equivalent of Annapolis for midshipmen is located at Sourabaya.

The most frequent questions I have been asked in the United States are "How many planes have you in the Indies? How many do you need to defend them against invasion?"

All I can say, as an air force officer, is that if I had 50 I would need 100. If I had 100 I would need 200. If I had 1,000 I would need 2,000. And I can't emphasize too much that the stronger we are the less chance there is of invasion and war in the Far East—and consequent difficulties for the United States. Our peculiar situation requires the strongest air force we can get. We are getting planes from America every month, a sizable number, but we need more—and quickly.

We have a third air arm to assist us in the Netherlands East Indies—a volunteer air corps of European and native civilians, a force that I understand will soon be duplicated in the United States. In eight cities we are training civilians to fly in government-furnished DeHavilland *Tiger Moths* made in Australia. Our Army instructors give them 70 hours of primary training, then a course of advanced instruction in faster army ships. After they have graduated, these Dutch, Chinese and native businessmen, professional men, clerks and students do coastal patrol during their spare time. They will all be called to the colors in the event of an invasion.

The Indies government has also bought several Lockheed *Lodestar* transport planes. Each one will carry about 20 men, each with 200 pounds of equipment. They have seats along each side of the fuselage as in all paratroop transport planes—which may tell you something else too.

There is a typical jungle trick which will be brought into play if an island invader attempts to land an army by parachute. Elephant traps have been built on those roads which they would be forced to use—deep pits covered with brush and soil which would collapse beneath the weight of a soldier and impale him on stakes in the bottom of the trap. Needle-pointed bamboo stakes surround our airports for the same purpose.

It is extremely unlikely that an enemy would benefit from the islands' many oil wells, even if they did succeed in penetrating the growing ring of defense we Dutch are throwing around our south sea territory. The destruction of every oil well in the Netherlands East Indies is well prepared. Everything that can be done has been done. But may I remind again that although a foe would not benefit from our oil, the United States would also lose the defense materials it needs and which we supply.

The most encouraging signs that have been given us since our home country fell to the Nazi invaders are the declara-

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WICHITA, KANSAS
CULVER AIRPORT

LET'S GO! U.S.A. KEEP 'EM FLYING!

tions of loyalty we have received from the native population of the islands. They are 100 per cent for us and against the totalitarians. The people of Java, Sumatra and Borneo have contributed many thousands of dollars to the Prince Bernard Spitfire Fund to buy *Spitfires* for the RAF. This is done in spite of the heavy taxes that are necessary to build up our own defenses. We also have received contributions from the Dutch West Indies on the other side of the world, which is loyal to the Netherlands Government in London, as we are.

I am not as completely informed on the activities of the Netherlands East Indies navy and its air arm as I am about the army, but I do know that our cooperation is so close that, in an emergency, we would operate as one. We have a very respectable navy afloat in our four cruisers, eight destroyers and a large number of submarines. We don't need an aircraft carrier. Such a vessel would be useless to us. We have no vast distances to travel over large bodies of water. Our defense requires fast movement between the islands over comparatively small stretches of open sea. The only other use for an aircraft carrier would be for offense and we have no intentions of attacking anyone that doesn't attack us first.

In addition to our surface ships, we have a large number of long-range aircraft and more are being received all the time. In our navy training schools, some of our most valued flight instructors are 12 American civilians. In the repair shops of the navy, as in the army, 95 per cent of the mechanics who service our planes are natives—every one a first-class workman who can be trusted with the most delicate and difficult tasks around an airplane.

Our future plans do not yet include the construction of airplane factories in the Netherlands East Indies. Construction, tooling and machinery purchase and transportation constitute a long-range job for which we simply haven't got the time. We will content ourselves with our assembly plants for planes shipped to us from the United States, and our ammunitions and small arms factories.

In my preoccupation over our desperate need for great numbers of additional planes, I neglected other war materials that only the U.S. can provide. These are small arms, machine guns, rifles and ammunition. Our army is woefully short of such weapons and we would like to get more of them. We have plenty of money and raw materials to give in return and we'll give them gladly. A new high figure of $169,074,000 in rubber and tin came to the United States from the Indies last year and more is coming this year. That's a lot of money in Dutch guilders or American dollars, and we want to spend it.

Maybe I have painted our prospects of beating off an invader in too-bright colors. That was not the intention. I meant to point out that we are doing all we can, with what we have, to try to supplement our natural defenses. We love our cities of Batavia, Bandoeng and Sourabaya, but we are prepared to blow them up with mines rather than let it fall into enemy hands.

Today, we islanders have two main aims. First, we want to make our island defenses as strong as possible as quickly as possible. Second, if we don't succeed in defeating the forces of an invader, we want to leave nothing of commercial or military value for him if he does decide to come.

Turn to page 14 for a discussion of the country that the Netherlands Indies fear most, Japan.—Ed.

END

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A RANDOLPH Field, Tex., aviation cadet, Ross W. Warmack, Ada, Okla., can confirm all reports about the realism of "flying" a Link trainer. When operators threw the device into a mock tailspin while Warmack was executing blind flight maneuvers, the cadet, overcome by the sensation of plunging earthward out of control, threw open the hood for an emergency parachute jump before he realized he actually wasn't aloft.

To the room full of laughing fellow cadets and the machine's operators he explained embarrassedly: "Well, it was plenty real to me and I figured it was time to bail out."

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The Pylon Eight

(Continued from page 46)

thing else, it's easy when you know how. It requires a high degree of kinesthesia, planning, feel and subconscious realization of what is going on. It is a maneuver that should be practiced at frequent intervals to give a pilot continued touch or feel of the plane. This feel must be retained if the pilot is to achieve the primary objective of eights on pylons.

This objective is to hold the wing tip *on* the pylon, or to hold the pylon on the wing tip, whichever sounds easier. In Figure 2, a sketch of a plane illustrates the maneuver and it may be seen that the pylon is the vertex of an inverted cone. The circle of course is the base of the cone, around which the airplane flies.

In computing "R," the radius of the turn (which is the distance away from the pylon), it must be clearly understood that the figures are reliable only when the turn is coordinated and free from skids and slips. In such a turn one is flying smoothly and with aerodynamic efficiency. Moreover, in a given bank a definite, unchangeable load factor is encountered, regardless of plane, weight, type or speed. This was pointed out in a previous issue of FLYING AND POPULAR AVIATION ("The Puzzling Turn," September, 1940).

Because of this fact we know several important additional facts about a turn. We know that, in Figure 2, the radius "R" and the altitude "A" can be computed very easily by two simple equations. The mathematics for the formula is as follows:

In a coordinated, level-flight turn, centrifugal force ($MV\Omega$) acts horizontally, while gravity (Mg) acts vertically. The resultant of these two forces is known as the "load factor" and may be easily computed because it forms the hypothenuse of a right triangle and therefore may be ascertained for any degree of bank thus:

$LF = 1/\text{cosine } \theta$ where θ is the angle of bank in degrees.

Centrifugal force may be stated:

$CF = \text{Mass} \times \text{Speed} \times \text{Rate of Turn}$

Or: $CF = MV\Omega$

But the tangent of the angle of bank is the horizontal component divided by the vertical component, or:

$$\text{Tan } \theta = MV\Omega/Mg = V\Omega/g$$

As the rate of turn (Ω) is equal to the speed (V) divided by the radius (R) we may write:

$$\Omega = V/R$$

(where V is the speed in feet per second). And then substitute above

$$\text{Tan } \theta = V^2/Rg \text{ or,}$$
$$\text{Tan } \theta \times R = V^2/g$$

With this information we may refer to Figure 2 and find that the radius "R" or distance from the pylon, and "A" the altitude, may be easily computed. For example by trigonometry:

$$\text{Altitude} = \text{Tan } \theta \times R$$

But likewise

$$V^2/g = \text{Tan } \theta \times R$$

Therefore

$$\text{Altitude} = V^2/g$$ where Gravity is 32.2 ft/sec

And again by trigonometry:

$$\text{Radius} = \text{Altitude}/\text{Tan } \theta$$

Thus, before the student or instructor goes out to practice pylons, it is possible to determine the exact altitude at which a pylon will become the vertex of an inverted cone. This does not imply that a pilot may fly entirely by his altimeter, however, because in rolling country his pylons may have an altitude different from the point of take-off. To be strictly accurate, the altimeter would have to be corrected to read true altitude over the pylons rather than the airport.

Suppose now that the plane is ready for the student and we know that it will cruise at 60 m.p.h. The altitude may be found before take-off merely by substituting in this equation:

$$\text{Altitude} = \frac{(\text{Speed in feet per second})^2}{32.2}$$

Let us try an example: 1 m.p.h. is 1.466 feet per second, so 60 m.p.h. would be

60×1.466 or 87.96 ft/sec

$(87.96)^2/32.2 = 77369.616/32.2 =$ 240.278 feet altitude.

Other altitudes may be worked out accordingly, using the same method. A table of speeds and altitudes is given herewith; note that an interceptor fighter with a speed of 400 m.p.h. would be required to fly at over 10,000 feet in order to hold a pylon on his wing tip.

TABLE 1 *

M.p.h.	*Altitude*
60	240
70	326
80	425
90	540
100	668
110	807
120	960
130	1,128
140	1,304
150	1,500
200	2,670
300	6,000
400	10,680

With this information we tackle the problem *en force*. The plane is flown to the pylon area and a very small object such as the base of a tree or fence intersection chosen for the pylon. Both must be on level ground because 50 feet difference will make it impossible to execute the maneuver on them correctly. It does not help to pick one pylon in a valley, the other on a ridge and then wonder why "something" is the matter. Wooded areas, with their strong eddies and bumps, should also be avoided.

Flying downwind between them, the first turn is started. Now it becomes apparent that there are four variables, namely:

1. Altitude.
2. Speed.

---

* *Note: (1) These figures have been computed with the supposition that the pylon is held exactly on the wing tip. If it is held slightly below the tip, a higher altitude than that stated will be required.*

(2) Figures are correct for no-wind conditions only. Required altitude will be more on downwind side, and less on upwind side.

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3. Bank.
4. Distance.

But, as was proved above, altitude depends upon speed and we may regulate the speed with the throttle. Therefore the first two variables are temporarily eliminated. (Practically, it is impossible to fly at exactly a given altitude because the altimeter lags, the ground varies and pilots have shortcomings. Also, air speed indicators are not sufficiently accurate, nor is the exact position of the pylon on the wing tip easy to judge.)

The second two variables—bank and distance—have been very confusing in the past. Yet, if speed and altitude are known, the radius may be determined by this easy formula:

$$\text{Radius} = \frac{\text{Altitude in feet}}{\text{Tangent of the Angle of Bank}}$$

Suppose a shallow eight on the pylon is desired. A shallow bank might be 20° and the tangent of 20° is given in Table 2:

TABLE 2

Angle of Bank	*Tangents*
10°	0.1763
20°	0.3640
30°	0.5774
40°	0.8391
50°	1.1918
60°	1.7321

Thus, in Table 1, 60 m.p.h. would require an altitude of 240 feet; from Table 2 the tangent of 20° is seen to be 0.3640. 240/0.3640 = 660, therefore we must fly 660 feet from the pylon in order to hold it with 20° of bank. Should we wish to make a 50° bank on the pylon we must divide 240 by 1.1918, obtaining 201 feet—

What *practical* use can we make of this knowledge? Fundamentally this: that for any speed there is a given altitude and that we may do steep or shallow pylon eights at that altitude. Practically, if we increase the throttle setting for steep eights and thus increase the speed, we must increase the altitude.

Again practically, we must use the four variables in order to correct the maneuver. For instance, if the wing moves ahead of the pylon the situation is analogous to flying along in level flight—that is, we are passing the pylon. Therefore, by banking steeper, we can hold it. On the contrary, if the pylon moves ahead of the wing it is quite the opposite: if we would catch the pylon we must resume level flight or decrease the bank.

But, it may be asked, why should the pylon move at all if the mathematics is sound? The answer is that there may be many a slip twixt the cup and the lip, that we don't carry the pylon precisely on the wing tip, that we vary our speed, altitude and distance.

Another thing, the distance is varied to a certain extent by the wind. With conditions of a strong cross-wind the airplane is continually drifted down upon the pylon, necessitating a steeper and steeper bank. As the wind increases, however, it soon becomes impossible to execute a good pylon eight because the ground speed changes and an increase of altitude will be necessary according to Table 1 if the ground speed increases. The drift, therefore, may be compensated by increased bank only within very moderate limits.

The last variable to be stressed is the angle of bank. Taking a concrete illustration, let us suppose that we have a 100 m.p.h. plane and wish to do 50° or steep pylon eights. The solution is as follows:

$$\text{Altitude is } \frac{(1.466 \times 100)^2}{32.2} \text{ or 668 feet high.}$$

$$\text{Radius or distance away is } \frac{\text{Altitude}}{\tan 50°} \text{ or}$$

$$\frac{668}{1.1918} \text{ or 560 feet away.}$$

But, when the plane is banked on the pylon at 668 feet of altitude, with the air speed indicating 100 m.p.h. the wing may move ahead of the pylon. The correction is made by climbing a few feet higher until the pylon is stationary, close to the wing tip. As soon as it becomes stationary the true corrected pivotal altitude has been found for the actual air speed and the maneuver can be performed at this altitude for any degree of bank.

But in this case a bank of 50° was wanted. If the wing tip hides the pylon when 50° of bank is attained, the distance out is greater than 560 feet. The plane must be then flown *closer* to the pylon, the plane must be moved away somewhat. As it is rather hard to estimate 560 feet from an altitude of 668 feet, some experimentation is necessary.

With these facts in mind pylon eights should become easier. One last touch must be put into the picture, however, and it is this: *never use rudder* in pylon eights *to hold the pylon* on the wingtip. Use it only to coordinate the controls—and to keep the little bank indicator ball in the center. Try and do it!

END

The RAF in the USA

(*Continued from page* 50)

they were put on active duty, manning machine guns around airport and other defense places, the RAF left me at home. Then, quite suddenly and without warning, I was called up and told I was going to America. I was properly thrilled, of course, because I'd always wanted to see the United States—the movie versions excited me."

En route to Canada and protected by cruisers and destroyers, their transport was said to be the object of the German battleship *Bismarck*.

"One day," May says, "some of our escort just turned tail and left us. Soon afterward the wireless told us about the sinking of the *Bismarck*. Neat work, what?"

"It was a *Catalina* (PBY flying boat) that really got her in the end," another Englishman reminds May. And while they are devoted to the RAF, all think highly of the Royal Navy. "Doing a splendid job," they say.

"Just look at this," one remarked, waving his hand at the Embry-Riddle school in general. "At home this would have taken years. The speed here is *terrific*, as you Americans say. I understand that at Christmas time last year (1940) there wasn't anything here except an old cement building. Now just look at these barracks, the swimming pool, the tennis courts and the classrooms and hangars. It's simply amazing."

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The kids who sit in the cockpits of the trainers have a tough assignment ahead of them and they know it. Already aware of what they have to face when they are sent home, they are grimly determined to prove worthy of all the expense their government and ours have taken.

"Mind you," declares one, "I'm not throwing a line. But after all this (gesturing to the air school) we'll make Jerry run."

The RAF lads have watched dogfights, have watched Stukas sweep across their homes and have watched their comrades come spinning down in combat.

"They're wonderful," says Cadet Leslie of the English fighter pilots, and there is nothing but sheer admiration in his voice. He forgets that soon he, too, will be up there over England as "wonderful" as those boys already on duty. "They come whipping into huge masses of Heinkels and Dorniers and you wonder how the poor chap is going to handle them. But somehow he always does. I've seen three *Hurricanes* go slamming into 50 Nazis and they always seem to scatter them."

On the other hand, they've watched *Spitfires* and *Hurricanes* come down.

"One poor chap got it right in front of me. The Jerry had driven him down quite low and he was putting up a scrap, I'll tell you. They cut his wings off and the *Hurricane* came crashing down in the street very close to me. The pilot bailed out, of course, and I believe he made it all right."

While the RAF lads work hard, they play hard. They are the favorite guests of civilians in the entire Arcadia section and civic clubs, churches, lodges and other organizations seek to make their stay here a happy one. Week-ends are theirs to enjoy, so long as they are caught up on their studies and work. They have tasted all the "strange" American foods they can get their hands on and have sampled the various liquids. Used to their "pints," they are permitted beer off the post and are at all times conscious that they are Englishmen, gentlemen and potential officers. They conduct themselves accordingly.

On the base, they wear a simple khaki overall and are not permitted to wear their RAF uniforms off the base. In town they wear civilian clothes and, except for their speech and new sunburns, you can't tell them from other youths. When they "dress up a bit" on the base they wear simple khaki shirts, black ties, black shoes and RAF flight caps. They have Canadian khaki tunics with red insignias embroidered on them, but wear them only occasionally. The Florida heat, incidentally, makes them long for shorts.

"Wouldn't it be wonderful," they ask each other, "if we could fly in shorts? Just like the boys in the Middle-East."

The United Kingdom cadets have a little private theory of their own about where they may eventually end up. "It *does* seem logical that while we are here in this climate that we may be getting our blood thinned out so we may be sent to the Middle East command, in Egypt and other African spots," they say.

Issued to them was a sort of sun-helmet-flying hat combination which they wear only as a shade from the sun and not as a flying head gear, as originally intended. Some well-thinking individual in England issued the fancy hats, but Arcadia instructors turned thumbs down on them. They offer too much wind resistance while flying in open ships for one thing and the ear flaps can't accommodate American interphone earphones. So the boys wear them while strolling around the base.

First of the Englishmen to solo was Cadet Ray R. Smart, of Sussex. He had just eight hours and 20 minutes' dual time when he made the circuit of the field. Many others were close on his heels. Smart, who was chosen to represent England in skeet shooting at the 1938 Olympic Games at Berlin but whose going was prevented by international complications, received the old Army business after soloing. The American cadets tossed him into the swimming pool to celebrate and the RAF boys all are now taking duckings on soloing.

Take the word of C. A. Zeman, one of the many instructors at Carlstrom Field, that the RAF lads are good pilot material:

"I have both Americans and Englishmen in my group," he says, "and they compare favorably. In fact, there isn't much difference."

Zeman's statement is enlightening on one subject: pilot requirements. A majority of the 99 trainees from England are not college educated and, in many cases, are grammar school or lower. The Americans are, as are all U.S. flying cadets, graduates of high school and have at least two years of college or its equivalent.

"They were a bit fussy before the war," Chesney says, "but when things picked up and the war gained speed, the RAF couldn't afford to be fussy and the non-university men were permitted to apply. Frankly, some of our best pilots are the non-commissioned officers, like sergeant-pilots."

Before coming to Canada, all of the cadets were trained at ground schools in England. They covered meteorology, theory of flight, navigation and allied subjects. Now, in the American schools, they are once again studying those subjects under the U.S. Army system. They admit they are familiar with the subjects but, in the words of one of them, "you can't learn too much of the stuff."

Only the lighter side of life at Arcadia, the RAF men are not as Hollywood would have us believe Englishmen are—a little dull on the humor angle. The boys like their pranks, their practical jokes. One discovers an Americanism and turns it on his mates. It spreads like wildfire through the base and soon all the boys are trying it. The same goes for speech. American cadets are saying "By Jove!, rawther, quite, old man, etc.," while the Britons are convulsed at Dixie drawls. They are especially fond of double negatives. One lad was overheard walking along a pathway saying over and over again:

"Ah ain't got no cokes today, ma'm."

To a man, the Royal Air Force men will lend an ear to swing music and cheer. They call each other "Butch," because several witnessed an American gangster picture which tickled them. They are losing RAF slang for Southern "cracker" talk and on the distaff side they can only whistle in wonder when you mention American girls.

"I say! Exactly like Hollywood describes them," they comment.

All in all, the RAF men in Arcadia are literally having the time of their lives. Yet they haven't lost sight of what is to come. From Arcadia they go to a basic training school at Montgomery, Ala. Then will come an advanced school. When their training is over, they will probably receive English commissions in

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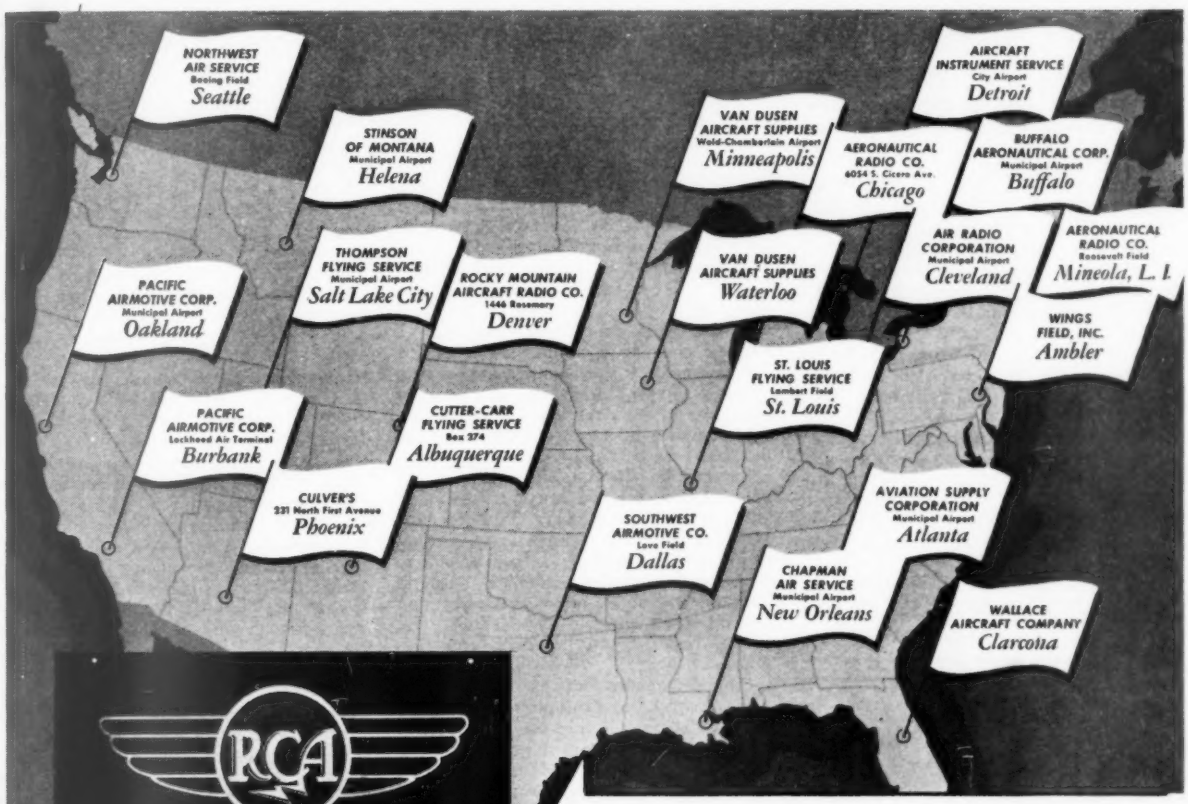

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Canada and start for home—and the job for which they are being trained.

Many of them plan to return to America as citizens when the war is over. Even now, as they fly, they are casting eyes on American businesses, memorizing techniques and practices so they will have more knowledge when they return. Many of them will take back to England some of the U.S.'s systems they have picked up. May, for instance, as a clothing salesman, is keeping a business eye on American civilian fashions and he promises some revolutions in British attire when he returns to civilian life.

None of them actually knows where he is going. None has ever been heard to voice an opinion other than he hopes it is soon. In any event, if the scheme continues its smooth, rapid pace, the 550 boys who now are in the United States will be in action by next spring and 4,000 of them will be turned out, the finished products of the finest aviation training in the world, each year. It's something for Adolf Hitler to think about.

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I Learned About . . .

(*Continued from page* 46)

15 or 20 minutes for safety. In that valley within easy range were three airports, at Riverside, Berwick and Wilkes Barre.

The clouds kept pressing down. I found myself at 1,500 feet anxiously peering ahead at the ridges in my path. They ran from 1,500 to 2,000. Ten minutes elapsed. I cut through a notch in another ridge. Now, for the first time, I was not quite sure of my position. I studied the map anxiously as turbulent air occupied my stick-hand. Landmarks were at a premium. I still had time to cut north to the river and follow its valley to the haven of an airport. But if I did that I might be stuck there all night.

I elected to abandon all thought of the river and to rely on my compass. If I held to a course slightly south of east, I reasoned, I must, with a following wind, come reasonably close to my objective. If unconsciously I veered south, I had to pick up Staten Island or, at worst, the South Jersey summer resort shore. If I veered north, I was bound to cross the Hudson River.

Considering the fact that the visibility was lowering, let's call that mistake No. 2-A. It stemmed from the bad decision not to turn back when the scud got bad.

I hadn't remembered so many hills on the course. And here was a lake I could not place on the map. Still, just south of east had to get me there—unless the compass had been calibrated wrong. I drove on, getting a little mad. I was sure I would cross and recognize the ridge split by the Delaware Water Gap. It was raining now and then and the windscreen was getting dirty.

I couldn't turn back if I wanted to. I didn't know where to turn. Ducking up valleys had destroyed my sense of direction and as for the map, it had gone completely cockeyed. I certainly would tell the Civil Aeronautics Administration about that! I scotched my worry with a sing-song reassurance that just south of east *must* bring me out at some recognizable place. But the ship was pitching and, more often than not, I was not sure just where south of east was. Lightplane compasses swing like a blues singer.

I went on. The choice was not mine. Happily, the hills were lower. I measured them by rule-of-thumb and the altimeter as the ship went over them.

The tanks held 4½ hours of fuel. No worry on that score. The rain had stopped but the visibility was getting worse by the minute. For the 25th time I glanced at my chronograph. I had been out two and a half hours.

Suddenly, ahead of me loomed a shoreline. It was a straight shoreline, what I could see of it, and for all I knew the water stretched eastward for 3,000 miles to Europe. The fact was that I could not see 500 feet ahead of the ship's nose.

Well! I wasn't so dumb after all. I knew now. This was South Jersey. I drew a sigh of relief, leaned back and lighted up. Now I would fly just east of north, crossing the New York Lower Bay and Brooklyn to Flushing. That might take me 20 minutes, maybe 30. Through the haze I saw the shoreline bear left sharply. The map corroborated that. But I couldn't see the sand spit stretching north from the Atlantic Highlands. Well, the visibility was miserable anyway and I was right on an air space reservation, so I had best follow the shoreline. With something below me I might recognize with a little study, I failed to check my map.

That was mistake No. 3.

The terrain failed to jell. What should have been Raritan Bay turned out to be a little inlet. Now instead of returning to the shoreline, I struck inland. I don't know why. I was bewildered and, for the first time, definitely uneasy. Where was I? I could not be north of my course. I would have crossed the Hudson. Obviously what I had seen back there was not the Jersey shore. I began wandering northeast, afraid to go back under miserable visibility conditions and find the ocean.

A shoreline sticks out like a sore thumb. That was mistake No. 4, according to my count. More accomplished flyers probably have added up to a dozen by now.

Now if I *were* north of my course, I argued, and *had* crossed the Hudson, a course due south would bring me to Long Island Sound. I turned south, flying five minutes to the second. I gave up. Too soon, as it turned out. I was more than three hours out. I had something more than an hour and a quarter of fuel left. I had best pick a field and get down. My ability to reason had been swallowed up by fright and embarrassment. I was thoroughly scared under the existing visibility conditions and I did not want to hurt the airplane in a forced landing.

I looked around, spotted a field, dragged it and pulled up for an approach. The area was a little hilly. What wind there was appeared to west-southwest. I had two 250-foot fields, one plowed, one sown in clover, without a fence between. I would have to sit down slightly crosswind, coming in over the plowed field—which was badly furrowed—and touching on the lip of the other one.

The ship squatted nicely and braked to a stop. The landing was the first sensible move I had made since leaving Lock Haven.

No one came out of the house at the end of the first field.

"This is going to cost me," I ruminated.

A hired hand outside grinned. "Lost?"

"Yes, where am I?"

"Redding."

That was in Connecticut. I felt my face getting red. Then I *had* been north of my course and I *had* crossed the Hudson—but how I had done it without seeing it I could not figure out. The track I had made began crystallizing now. I had been blown ever so slightly northeast. In 175 miles of flying, the better part of it by compass alone, I had emerged over the shore of Long Island Sound at a point where the shoreline ran in almost a north-sound direction. That had confused me. At that moment I had been less than seven miles off course.

(*Continued on page* 83)

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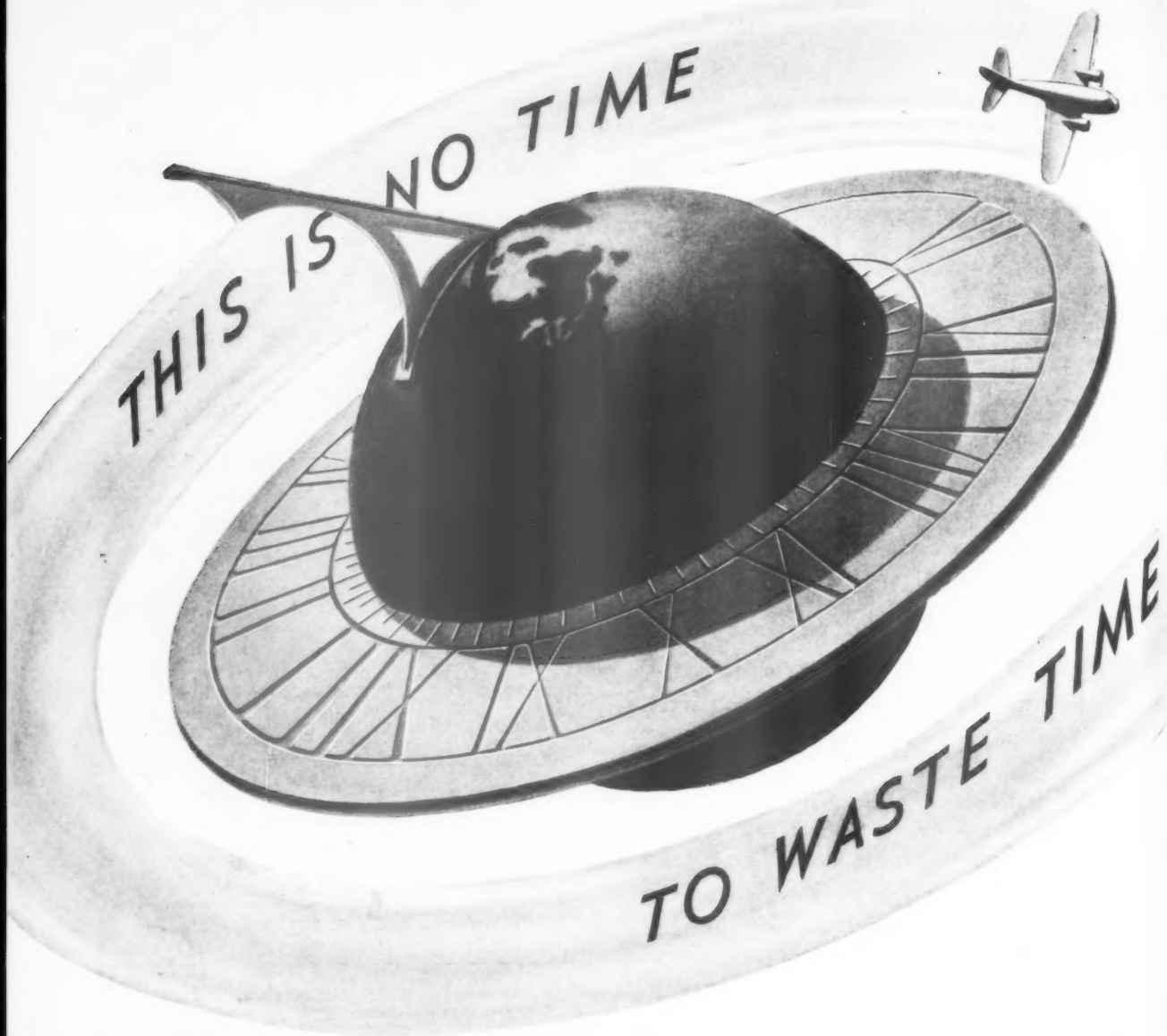

"THIS is no time to waste time!" is a theme recently adopted by the Air Transport Association to impress on the public the time-saving importance of flying. And who can tell for how long *speed*—of transport and production—may be vital to America's stake in civilization?

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ADVERTISEMENT NUMBER SEVEN OF A SERIES ALSO APPEARING IN TIME AND FORTUNE

(*Continued from page 80*)

The farmer, surprisingly enough, was pleasant. If the ship was equipped with a tailwheel instead of a skid, he said, I hadn't done much damage. He, his wife and the hired man, walked out to see me take off. The ship bounced but it staggered aloft. Now I would fly slightly west of south, strike the Sound, and follow the shoreline.

That was mistake No. 5. I should have flown directly to Stratford and checked the weather. But Flushing Airport could not be more than 20 minutes away.

The visibility kept getting worse. I dropped from 2,000 feet to 1,500 and finally to 1,000. The Sound popped up out of nowhere. I cut southwest, flying just offshore. The shore was hard to see. I edged closer. Then, as I strained my eyes to keep the shoreline in view, the squall struck.

The ship was tossed around like a leaf in a gale. I had to keep an horizon or run the risk of stalling and spinning in. I dropped to 100 feet. The line between Sound and land was dim. If I stayed over land, I ran the added risk of colliding with something. By dint of pulling and hauling I managed to get the airplane headed out over the Sound. Now I dropped down to within 10 feet of the water. I had to. The rain was coming down in sheets.

I was riding on a miniature gale, lashed by rain, straight east over the choppy waters of the Sound. Updrafts and downdrafts rocked the ship. For the first time in the eight months since I had received my ticket, the idea entered my head that I was going to join that select company of pilots who had not been able to walk away from an airplane.

This was my last ride. In the next three or four minutes the conviction that my number was up became so fixed that, even while fighting the ship, I found myself wondering when and how they would find the wreckage.

Then, to the south, I saw a lighter spot in the sky. I could not turn at 90° but I could crab, foot by foot. Presently the rain began to lessen. From my meager 10 feet of altitude I climbed for a space to breathe. I was soaked through, but whether from rain that streamed into the cabin or from sweat, I did not know nor care. As I turned, picking up the Long Island shoreline, I could see the squall still raging over the water.

The visibility was not too good and rain still pelted the ship, but the way to Flushing Airport was clear. Afterward I measured the distance from the point I encountered the squall to the point where I came out. In an 85 m.p.h. plane I had been blown 12 miles in five minutes.

As I climbed out, shaken and weak, in front of the hangar of Speed's Flying Service, the imperturbable "Speed" Hanzlik, who has been taking his airplanes in stride for more years than he cares to remember, was lolling in the doorway of his office.

"Just get in?" he asked, glancing incredulously at the whipping windsock.

"Yes, I got lost, badly lost."

"Lots of guys get lost," observed Speed.

"But not like I got lost, or as scared as I got," I objected, reaching for a chair for support.

"Lots of guys get scared, plenty scared. How's for a cup of coffee?"

I felt better, somehow.

END

Prophet

(*Continued from page 31*)

When his family moved to Seattle, Gilmore went to Pullman, Wash., to attend the agricultural college. But the stories of man's attempt to fly distracted his attention. He recalled a book quotation:

"When man has robbed from the eagle his eagle secret, he shall be able to sail through the air unconcerned."

During the summer vacation of 1891 young Gilmore made his first attempt to rob the eagle of his secret. He built an ornithopter-type airplane. Flapping wings were attached to his bicycle and these the boy worked manually. The machine "was unwieldy and lacking in balance," but it was a beginning.

He soon abandoned his flapping-winged bicycle for a rigid type plane. From another complete set of drawings, he set to work constructing the new flying machine. It was then "Papa" Gilmore put his foot down. He told Lyman he would break his neck trying to fly like a bird. Not only that, money intended for the boy's education was going into this foolhardy venture. Determinations of the two clashed and Lyman left home and returned to California where he got a ranch job. Years later when, with other skeptics he was forced to admit his error, Gilmore, Sr., did everything he could to help Lyman, even to sewing the fabric on the wings of a giant 1906 monoplane.

When Gilmore wasn't milking cows or making hay on the Redding ranch in the spring of 1894, he worked on his new flying contraption. He made a glider with an 18-foot wing, covered the wings with muslin, waterproofed them with "dope" of his own concoction. The dope was a flour and water paste for the first coat, a mixture of glue, rosin and rubber cement for the second.

Gilmore, who never considered a biplane in his plans, said, using his characteristic pronoun "we," never "I":

"We worked entirely on the bird theory, even to making hollow struts and other parts to correspond to bird feathers."

First he launched it from a level field into the wind. It sailed a short distance. Next he hauled it to a hilltop, used horsepower to tow the glider. The horse trotted down the slope, dragged the tow rope taut, pulled the glider into a take-off. Gilmore claims to have made his first actual flight in July, 1894. He declares he kept the ship aloft at an altitude of 50 feet for 500 feet.

"Our legs dangled below the glider and in landing we had to run along the ground," he said.

Working constantly on designs and models, he coasted along on his construction work until the spring of 1895, when he moved his workshop to the Sierra Nevada mountains near Dutch Flat, picturesque

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mining town. He chose the site in American river canyon because cliffs and rising air currents were needed in his experiments. There, too, he could study birds in flight.

In the next three years, he conceived and worked out, on paper and with models, basic details of the present-day airplane—a cabin monoplane with thick wings. He used white ash because of its lightness for the framework, then put on four thicknesses of laminated wood, glued and bolted together for strength. By 1898 he had plans for a steel ship complete. It had space for eight passengers and retractable landing gear. The motor he designed—another invention in advance of the times—was a radial, eight-cylinder type, balanced and easy to crank by hand.

Lack of money forced Gilmore to work in Grass Valley mines and experiments had to wait. But so sure was he that he had the key to the airplane of the future that in 1898 he wrote the War Department, urging the Government to build a fleet of ships. It was his contention that a "downpour of dynamite" from the air would wreck any fleet on the water. But the War Department would have none of his plan. In a letter to Gilmore, department officials said it would be necessary to attach balloons to such airplanes!

Gilmore refused to be discouraged. Yet he knew he must master the "secret of flight." He said:

"At first we thought as did the Wright brothers—that the ship could be controlled by skill, by shifting weight from side to side, forward or back. But it wasn't long until we knew no plane could fly any great distance unless it was balanced."

Gilmore's brother and one or two other men who were working in the mines gave him lukewarm assistance in the actual building of his gliders and planes. But in April, 1896, they grumbled they could no longer help him. He was a failure, they said; it was time for him to forget his crazy idea and turn to mining seriously. Why, they'd even supplied him with money and what were they to get out of it? Gilmore pleaded for one more day. If they would help again and he again failed, then he would quit. Grudgingly they acquiesced.

That night he climbed a nearby hill to watch the birds. He saw the birds go to rest, noted nighthawks and bats flying in the moonlight. In the morning he saw the birds awaken and fly away. Today, on that hilltop where he kept his vigil, an airway beacon points the way for pilots on their night flights.

That day Gilmore worked as he never worked before. But his efforts were fruitless. Still he could not give up. He persuaded his helpers to extend the time still another day. That night he visualized a plane flying overhead and it seemed to him the motor was in front of the cabin to secure proper balance. That was it! Early next morning he put his steam engine in the front of the plane, made ready for a trial flight. Just as he was ready to cut it from its moorings, his helpers lifted a sandbag to the tail.

"We're not going to stand by and watch our time and effort, our money, sent to the scrap heap. It must have weight to counterbalance the motor."

The glider staggered and settled to the ground. Disgusted, all the men except Gilmore left the spot. Alone he quickly tore the weight from the tail, dragged the plane to the starting point and cut it loose. It soared, graceful as a gull; sailed 200 yards and came to a perfect landing.

"We had robbed the eagle of its secret!" Gilmore said. "That was the solving of the center of pressure and gravity whereby all ships can fly, but without which no ship can be made to fly."

In 1902 Gilmore claims to have made the first long distance flight when he started the steam engine of his small monoplane and flew 500 yards, turned about and returned to the point from which he started. During the next five years Gilmore heard other men win praise for doing the things he had done before them. With aviation established definitely he built an airdrome in Grass Valley and put an airplane landing field in shape. In 1908 the field was surveyed and opened to general use.

In 1907 he built the cabin monoplane he had designed in 1898. It was basically as modern as the giant transports of today. Wing span was 65 feet and the propeller was in front. It was not until two years later that tractor propellers made their debut into aeronautics. The center of gravity and air pressure of Gilmore's huge ship was scaled on the drawings and, when completed, its construction was so accurate and weights so uniform that the center of gravity was not more than one-half inch off the center of pressure.

"Unable to raise money to buy an engine for the big ship, we bought one of the first Durak motors imported into this country by Santos Dumont for balloons," Gilmore related. "The motor could not turn the heavy propeller, however, and we had to build a smaller model that would not tax the motor too heavily." To the residents of the area, Gilmore's eight-passenger cabin plane came to be known as "Noah's Ark." Gilmore laughed at their jibes, told them that, like Noah, he needed a flood to launch his craft—a financial flood.

All his planes and models and many of his plans burned six years ago when a careless night watchman set a candle on the tail of the relic plane, then went to sleep. Occasionally now, he drives out there, looks at the ashes of his work, kicks through the upstart weeds at metal parts of his planes, distorted by terrific heat.

He still is mining, still hoping to develop property that will bring him money for further experiments. Some day he believes he will build a plane embodying the best features of automobile and airplane. As he told the writer his story, he sat on the front porch of his home where he lives alone. He's never married; has remained an individualist. He likes his beard and hair long, so why cut them to adhere to convention? While he talked, a bee buzzed from flower to flower on the vines.

"See that?" he asked. "Easy, isn't it? Some day we'll all be flying as easily as that."

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He Flies the Range

(*Continued from page 47*)

states, he had to drive frequently to the ranch. Much of the range was criss-crossed with gullies and arroyos, so there he had to transfer to his horse.

There are a hundred jobs if you run a herd of beef cattle. Strays have to be rounded up. Cattle must be branded. Herds must be moved from pasture to pasture. Someone must constantly check on the condition of forage, the water holes, the effect of the last rainfall. Fence-lines must be ridden to check for wires that may be down. If coyotes start preying on the herds they must be hunted down and killed. Madera had to keep a check on all those jobs, know what his men were doing, direct the work.

It was B. F. Hines that gave him the idea that made his double-barrelled job simpler. Madera was riding the range that day, hot and sweaty, when he heard a plane overhead. He reined up and watched. The sky was clear and almost white with the heat of the blazing sun, but at a thousand feet the pilot would be cool and out of the blinding dust. "Things like that give a fella ideas," he said. He turned the horse back to camp and got into his car. He was going back to Jal and he was going fast.

Very few towns in the west have large enough population to support a pilot-instructor and his plane but B. F. Hines, now of Hobbs, N. M., but then working out of Wink, Tex., had the idea he might make good with a string of air schools. If he called at each of half a dozen towns, each would doubtless have a number of students. In Jal he found eight men and a girl who wanted to fly. And when Malcolm Madera drove up in his dusty car, Hines had nine men.

He didn't have a plane long. Madera put in every hour he could and, when he was due to solo, he bought the plane from Hines so that he could have the satisfaction of soloing his own airplane. He soloed two days later, but let Hines use the plane for a couple of weeks to finish soloing the rest of the class.

Kate Madera didn't know her husband had been flying. She was a western ranch girl and, in the west, things are on a big scale. Mountains, for example, that tower up and up till you get dizzy thinking about their summits. But no matter how high you climb on a mountain your feet are still on the ground. She had never been farther off it than the top of their windmill. And she wasn't going to get any higher than that, either. So Madera was a little worried about her reaction.

Secrets can be kept just so long. She drove out to the airport one day and saw him landing his plane. He walked over to the car uneasily. But Kate smiled. No, she did *not* want to go up. No, not even if he flew her himself. No, of course she didn't mind if he flew. "But . . . you'll be careful? . . ."

Madera has been careful. He hasn't had any adventures, he says, because he "doesn't fly that way." Flyers bred in a softer country may not agree.

The little J2 *Cub* trainer replaced his car and horse. On rough and winding roads, the car was slower than the *Cub* which could cut across country. On the range the plane was faster and less tiring than the cayuse. With a few hours of solo, he used it exclusively for riding the range. All the various duties could now be completed in hours instead of days.

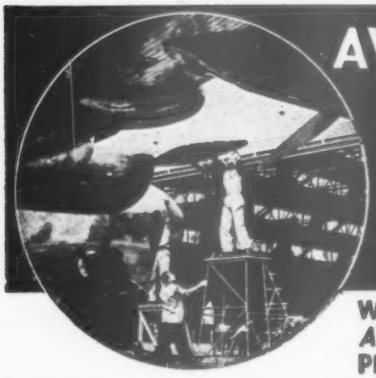
There were problems, of course. There were no landing fields and his ranch is at 5,500 feet altitude, but he soon learned the tricks of sideslips and serpentine approaches into small spaces. The thin air made landings speed up, of course, and take-offs slower but, after all, he had learned from the first under those conditions.

Thermals over the sand dunes "make flying a darn sight cheaper than driving a car," he grins. "Can't drive a car on hot air!" He literally does fly his plane on hot air. At a fairly good altitude, he throttles the motor and rides thermals the length of the range. "Might as well if you're checking forage or rainfall," he says. "Nobody's in a hurry when he does that anyhow and, even with the motor throttled, it's faster than a horse."

In March, sand storms come up suddenly and blanket the country in a gritty smother. Madera did not try to ride them out. When the sky turned an ominous yellow, he sat down. He staked the wings, bracing them securely against the wind, tied a lariat over the tail with a seat cushion to protect the finish, tied a blanket tight around the motor. The plane secured, he tied his kerchief over his face and ducked back into the cabin till the air cleared.

The plane makes a lot of fun possible, too, that he had almost given up. There are a lot of deer in a canyon over by the Home Ranch where his dad lives. One morning he took off at dawn, flew over and landed in the canyon, shot his deer and carried it back to Jal before 10 a.m. Antelope hunting was back on the program, too, and hunting coyotes and wolves from the air took on a thrill it had never had on horseback.

He played with the idea of using the plane on long cross-country for a long time before he tried it. Buyers from Dallas, Fort Worth and Oklahoma City had to make trips to look over his



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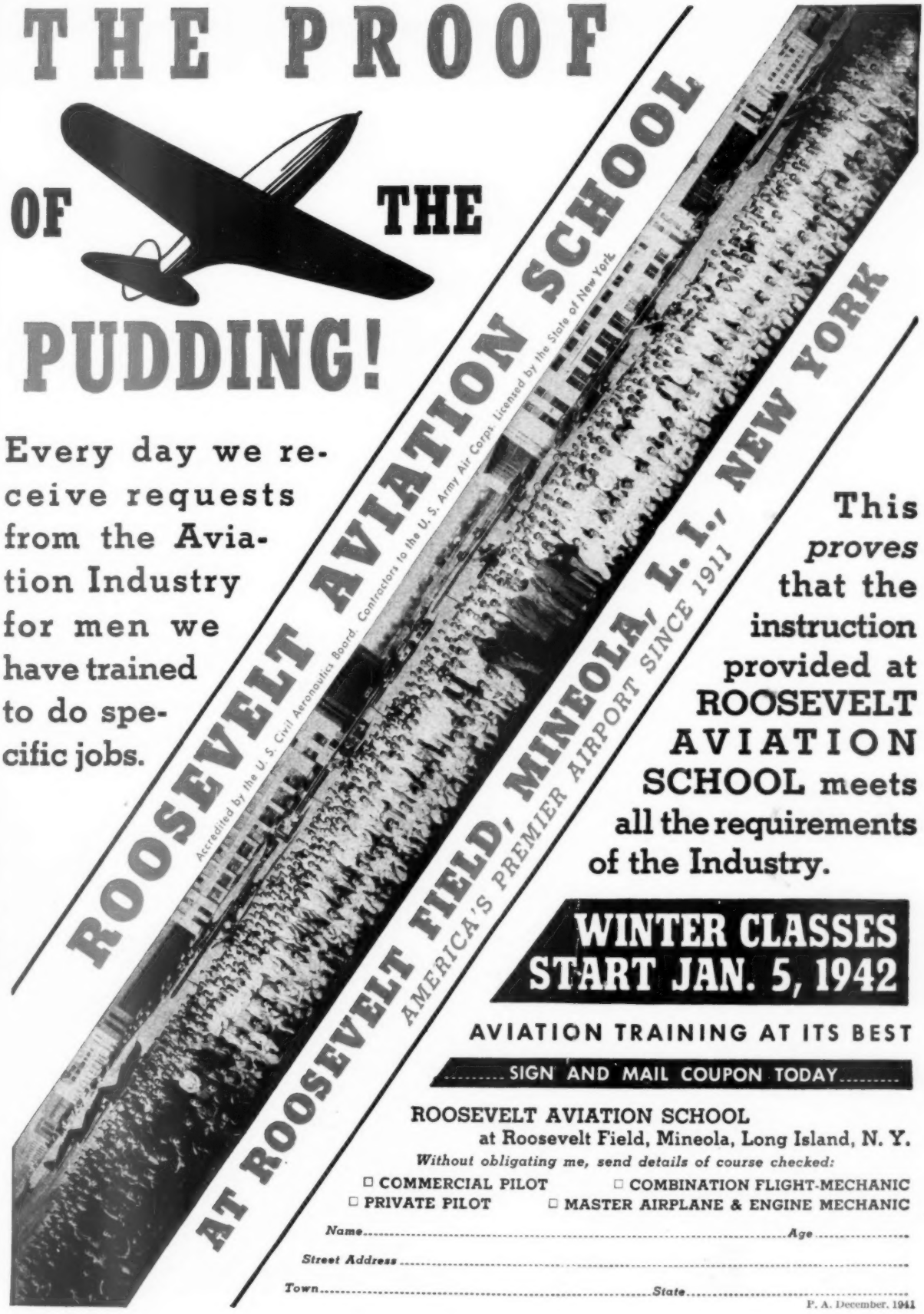

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P. A. December, 1941

cattle but it would speed the transaction considerably if he could pick them up when he was in those cities checking on his water contracts, take them to the ranch and return them to Jal where he now lived. The superintendent and his assistant at the El Paso Natural Gas Company offered to buy the trainer.

Madera telegraphed an order to Hines for a new *Cub Coupe* and branched out. He not only flew the range, but he checked the pipelines and conducted his water supply business chiefly from the air. Trips to the cities now took a single day. He could discuss terms with the commission buyers about his cattle in the air on the way to the range or on the way home to Jal.

He can't see why anyone hesitates to fly. "I handle my water business and the ranch chores now in less time than one job took in the 'horse and gas-buggy days'," he says seriously. "A car's just no good in the west except to play around towns. That's why Kate is the only one who uses our car now. It takes me too long to get into town, get business done and get back to work. Distances are too great and roads too bad in the ranch country to be tied down to an automobile."

But he admits he does not go quite as far as the lady dudes think he does. Some women had ridden out to his ranch to see the herds when Madera and a cattle buyer landed alongside the cattle. They got out wearing the typical blue levis, ten-gallon hats and high-heeled boots of the cattleman. The ladies thought it just too, too cute!

"Oh, look, Mabel!" one of them squealed. "The cowboys have all traded their horses for airplanes."

The cowboys have lost so much of their glamor they read cowboy pulp-paper thrillers to see what they are missing—but they still ride horses. Even Madera admits it would not work if *all* the cowhands took to the air but, for the boss, it's the only way to get around.

Daughter Lee Ellen, who has reached the ripe age of almost a year, is being brought up in the air. Dad traded in his *Coupe* on the newest model a short time ago and Lee Ellen was one of the first passengers. He put her hand on the stick before they took off.

"Might as well get the feel of the plane now as later," he said. "This gal's going to be a belle of the planes."

END

Lapsed License

(*Continued from page* 37)

mechanics. In this time, 200 college students were trained as pilots, a new aircraft mechanics school started and Thunderbird Field, the Air Corps's first primary school in Arizona, was built.

Part of the congestion at Sky Harbor when I arrived was due to a group of 20 or more pilots taking the Army course to qualify as instructors. I was started with Ralph Jordan, CPTP instructor at Thunderbird Field. After the physical exam and issuance of a student permit, I was ready for my first lesson.

We were assigned to a 65 h.p. Luscombe which I grew to like very much. It felt good to be in a cockpit again. Kicking right rudder and swinging around with the steerable tail wheel I lined up on the runway, pushed the throttle full ahead and eased the stick forward. We were off. I felt far from cocky. I was learning to fly all over again and it wasn't easy to overcome bad habits formed in past years. I decided the wisest course was to convince myself that my instructor knew more about flying than I did even though I had more hours to my credit.

Flying the Luscombe, I felt quite comfortable and unworried. But I was not entirely at ease, for the lay-off from flying—except for a bit of soaring—had made me pretty rusty. My coordination of stick and rudder in turns wasn't at all up to par. I had to practice shallow, medium and steep Figure 8 turns around road intersections at an altitude of 500 to 800 feet. Continually I used too much rudder.

After practice on "8s," we went upstairs to try power-on and power-off stalls at 2,000 feet. My first stall was abrupt with a clean break and the ship's nose dropped straight down with no tendency to wing off sideways. This was easy, I thought. I never was taught this maneuver when learning to fly 12 years ago. Next time I learned it wasn't so easy. The break wasn't clean and the Luscombe wallowed off to the right. My reactions were too slow in anticipating the swing of the nose as it dropped. After practice I finally got so I could tell when the nose wanted to swing. But I continued to over-control the rudder, which didn't help the situation. I had the same difficulty with power-off stalls.

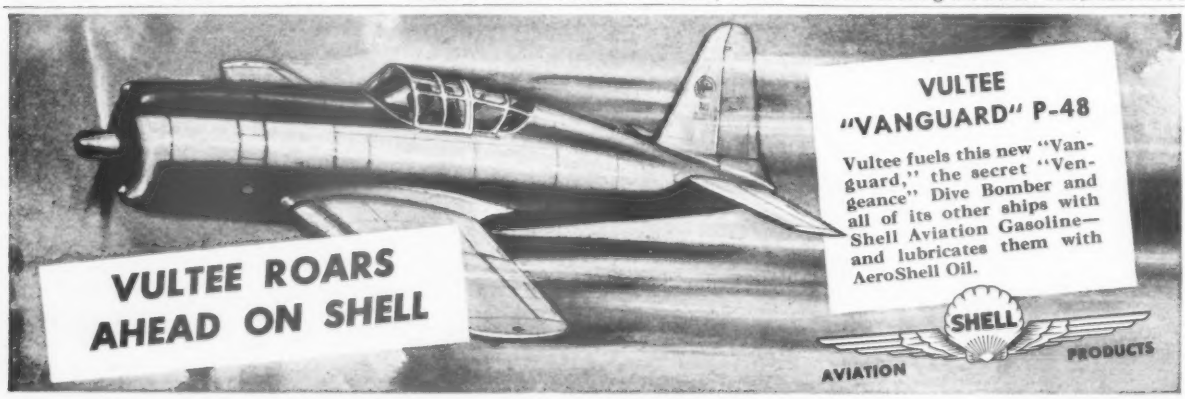
Seven-twenty power turns—which, when I first learned to fly, we called steep or vertical banks—were eye-openers to me. I had been taught to roll into them smoothly with little or no rudder and then when the turn was under way, with the stick held back to hold it there, to keep the nose relative to the horizon by using top or bottom rudder. This is now taboo. To raise or lower the nose you shallow or steepen the bank while coordinating the rudder with the stick.

Landings were my only satisfaction. My instructor was pleased with these. But my airwork wasn't dangerous and I soon soloed. Alone, I practiced coordination on turns by doing a continuous series of 180° turns back and forth across a straight road at 500 feet. Flying directly across the road with wings parallel to it you start a turn to the right when the ship crosses the road. At 90° you look out to see if the axis wing is perpendicular to the road. The turn is completed and the ship level again just as the road is crossed going the other way. It is best that the turns start shallow and end up steep (or vice versa). It keeps you on your toes.

On this first solo in seven months, I went up to 1,800 feet and tried some more stalls. Before, in the power-off stalls, the engine showed a tendency to rev low and almost quit, so I had to keep a couple hundred or so extra r.p.m.'s on when stalling. This time, when the nose started up, the engine revved down and when I pushed the throttle ahead the engine quit cold. My first reaction was annoying and frightening but I snapped out of it and dived the ship to start the engine. This experience was new and I didn't know how much air speed was required to turn it over. About 120 m.p.h. would have done the trick, but when I tried 110 m.p.h. with no results I levelled off and thought about making a landing.

The airport was three miles away and I was down to 1,400 feet, so I decided on a large clear cotton field below. The light wind there was parallel to ditch rows, but it had been raining and the soil looked soft. I thought sure the wheel pants would dig in, flopping the ship over.

In making my approach over a high row of cottonwood trees, I didn't worry about reaching the field. The Luscombe's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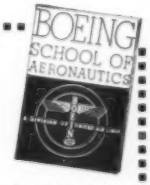

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glide was comparable to that of gliders I had flown. I slipped the ship in and it rolled bumpily to a stop. Carburetor ice probably caused this forced landing as I was near the cloud base on a cold day.

The rest of the course—half dual and half solo—I completed without mishap. Spins came easily, when I found out how perfectly the Luscombe comes out when the stick is eased forward. I used to line up along a 10-mile stretch of section line road at 3,500 feet altitude, pull up into a stall with power off, pull back on the stick and kick full rudder. As the ship fell off into a spin I counted the turns "One—one and a half" and then between that and one and three-quarter turns eased the rudder into neutral and just as she swung into line along the road for the second full turn popped the stick forward and she came out neatly in a dive, right on the line.

Spot landings weren't hard either, but they required plenty of practice for consistency. Chief difficulty was due to the thermals and consequent downdrafts usually found in the hours from 10 to four. Soaring conditions in this section of the country are ideal, you are convinced when you can make two turns of a spiral and find yourself at the same altitude or higher than when you shut the engine off.

Finally, there was the flight test for Inspector O. P. Hass. The solo part—right and left two-turn spins and three spot landings—went off all right. I "blew up" and flunked the test when I took the inspector aloft. My eights were awful; I was skidding or slipping in the turns. Worst of all was my habit of continually moving the stick. This was purely nervousness and hard to lick. I wasn't conscious of it, but it licked me on the test. I also stopped the power turns too soon.

A month later, after putting in six more hours dual and solo, I tried again. This time my instructor was John Franks. Jordan had gone to Thunderbird Field to train Army pilots. I shall always remember John's patience and interest in my problem. This really helped me over the hump. With concentration and practice, I managed to overcome my faults and get through. I learned happily that I was to get my old number—7,989—back.

Looking back on this experience and knowing how much harder it is to get a commercial license back than to get it in the first place, I realize there has been an advance in instruction technique that is very important to air safety. In my case I know I am a better and safer pilot than before.

END

Radio Instructions

THE Civil Aeronautics Administration has prepared a list of "do's" and "dont's" being sent to all CPTP operators which contain proper instructions for the installation and care of aircraft radio equipment.

According to the bulletin, radio equipment that is improperly installed and operated is a dangerous fire hazard. The following instructions were issued:

Don't operate the transmitter or receiver in the hangar.

Don't have any radio equipment turned on while gasoline is being put into the airplane's tanks.

Don't permit anyone other than an aircraft radio technician to work on your aircraft radio equipment. An aircraft radio is designed and built for one particular purpose and should only be repaired by a person who is specialized in that type of radio equipment.

Don't permit the drilling of any structural parts of the airplane for the attachment of mounting brackets without the approval of the CAA or the airplane manufacturer.

Don't use bonding of improper length on the control wires. (Bonding that was too short has been installed on control cables and did not permit the full travel of the cable. Bonding has been installed which was so long that it became entangled in the control cable pulley.)

Don't operate a radio when the gasoline tank is not properly bonded.

Don't use unshielded wire on electrically operated flares. Since very little current is required to release these flares, shielded wires should be used and the shielding securely grounded.

Keep the shielding connections tight at all times. This will not only keep water out of the shielding but will eliminate ignition noise.

Keep antenna connections and ground connections clean and bright.

Check floor boards for pockets and holes where microphone or controls that might become loose could fall through and possibly foul the plane's controls.

Keep microphone cords short enough so that they will not get twisted and break, or become entangled with the airplane controls.

Be sure that the antenna is clear of any airplane or structure that might act as a ground when testing the radio before flight.

Accident Figures

ACCORDING to a statistical analysis prepared by the Civil Aeronautics Administration, 1,269,231 miles were flown per accident by private flying operators during 1940. In 1939, 916,846 miles per fatality were flown. The total number of accidents in private flying increased from 2,175 in 1939 to 3,446 in 1940, but the number of miles flown rose from 177,868,157 in 1939 to 264,000,000 in 1940. In the 208 fatal accidents during 1940 there were 330 fatalities as compared with 194 fatal accidents and 314 fatalities in 1939.

END

Pilot—Your Eyes

(*Continued from page 44*)

has to employ effort to see at any distance, but less effort at far than at near and so finds far vision easier. The myope can read at a merry old clip close up, but far-away images look fuzzy to him. The focusing in these cases falls in front of or in back of the retina. Astigmatism blurs at all distances and throws everything out of proportion.

Once the eyes have been corrected with lenses in cases of any of these errors, they are equal to almost any and all others. The only disadvantage is that you may not look as pretty as you'd like with glasses. Beauty in this case is far better sacrificed to utility. Even that sacrifice is being lessened by use of contact lenses and a wide range of lens mounts.

If poor eyesight grounds a man, that's no reason for his giving up interest in aviation. The scientists and designers and physicists who wear glasses and have contributed long strides toward aviation's progress could fill a large volume.

It's not these cases of established poor eyesight that should concern pilots so much as the cases of neglect of the eyes. Errors should be treated by eye specialists, but protection of normal eyesight is the responsibility of the individual. In too many instances the men who've passed the examinations let their eyes go and make no effort to keep them in condition. Eventually they're bespectacled.

A common hint of possible trouble in the offing comes when the person who sees well both in the distance and close up habitually goes to sleep after 30 or 45 minutes of steady reading. This means that the reader is straining his eyes unbeknownst to himself. The going to sleep parallels our losing consciousness when we are subjected to excessive pain. The strain may not be strong enough to cause a headache but may be sufficient to cause

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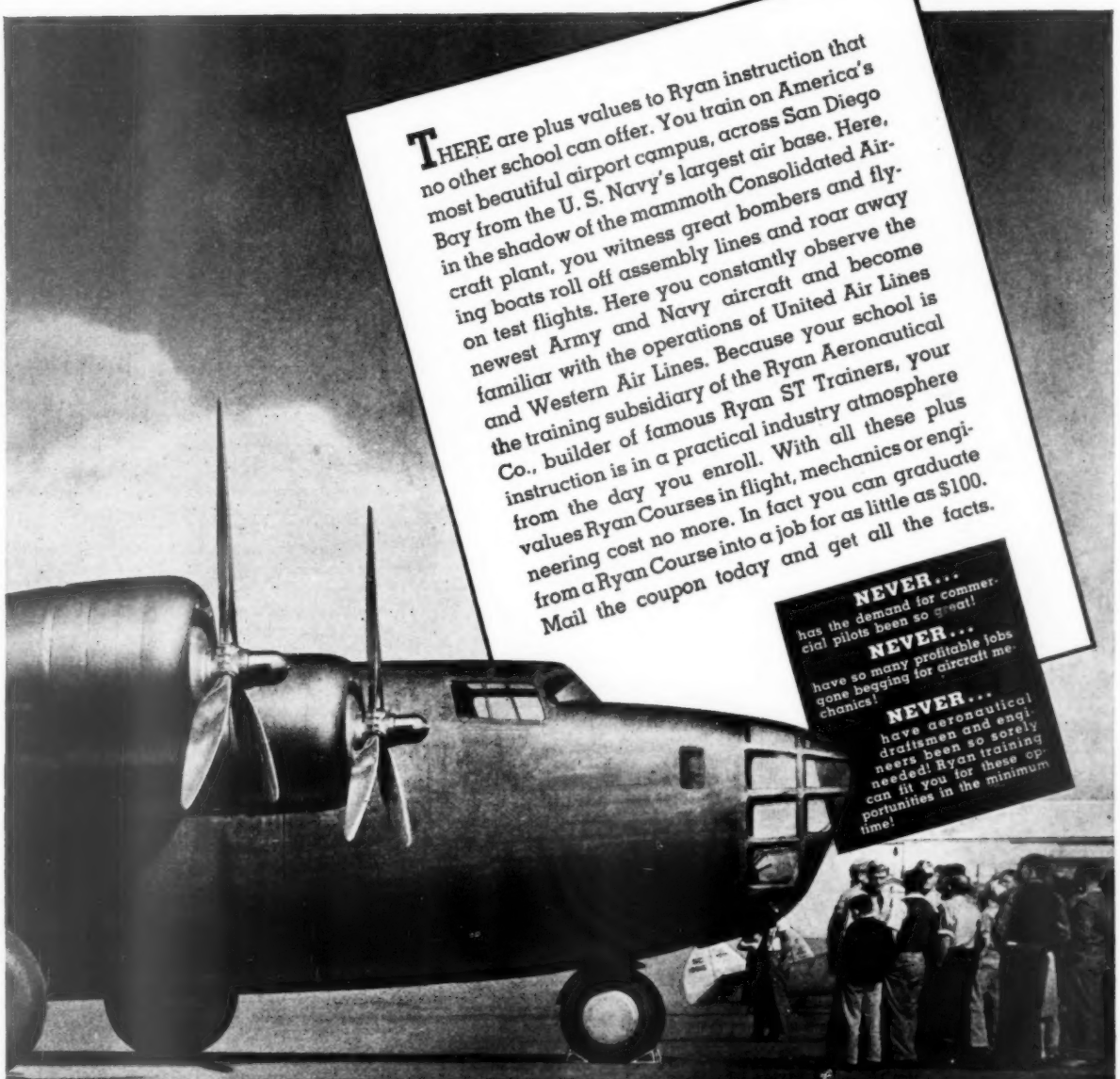

Ryan students constantly "rub elbows" with the latest in aircraft. This group inspects the giant B-24 (Liberator for Britain) at Lindbergh Field, San Diego.

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sleepiness. It may be poor lighting, glare, heat or muscular unbalance—but whatever it is slap a check-rein on it in its early stages. The driver who falls asleep at the wheel of a car, or the pilot who does so while flying, is a potential projectile of death. The reader who finds himself straining his eyes may help them by checking the volume, quality and direction of light and also by wearing lenses while reading. These are nothing more than magnifying glasses (plus lenses) conveniently mounted in eyeglass frames so they can make the rays of light reflected from the page focus on the retina. Sometimes the vision is benefited by exercising them through orthoptics.

The eyes are cool and comfortable at the end of the day when you've been flying with tinted lenses that cut out the ultra-violet and infra-red rays. Glasses which accomplish this same end may be obtained for everyday life especially for the summer season, both as ordinary sunglasses and as corrective lenses.

On hot, dusty days the eyes feel itchy and irritated. To relieve them of this burning feeling, a mild solution of boric acid in water may be applied with an eye cup. This is as safe and inexpensive an eye wash as you could wish. There are many commercial ones on the market at considerably higher prices. Some relieve the eyes faster than boric acid. Others have drugs in them which constrict the blood vessels in the eyeball covering to eliminate bloodshot eyes. Like all other drugs, if these are administered regularly the body builds up a tolerance for them and increasingly larger quantities of the drug will be needed to do the work. If you use these drops for the above reasons, do it as infrequently as possible—and preferably only upon medical advice.

A more dangerous and stupid use of drugs by aviation enthusiasts is the sort that is administered by unethical practitioners to help the pilot pass his physical examinations. The use of these drugs may enable him to read the chart letters better than he could without them. The pilot passing examinations in this way—assuming he could get past a foxy examining board with a trick with which they're very familiar—is taking his life in his own foolish hands and doing aviation and possibly his country a grave injustice.

There's some hokum wandering about in the form of gossip or propaganda that the Army uses color blind people to recognize camouflage. The color blind person can't recognize it any more readily than the person with normal eyesight—and sometimes not nearly as readily. Color blindness should be corrected if possible. It's no asset.

The man with perfect eyesight shouldn't get smug about it. He should remain as constantly alert and mentally sharp as his intelligence permits. Seeing involves the brain as well as the eye. Therefore a high I.Q. is invaluable to the pilot being examined or using his eyes in flying. The ability to react quickly to something as soon as it's seen means a lot in military flying. In fighting or pursuit work the sights are on the enemy ship for only split seconds at a time. The pilot must fire and maneuver in almost a single operation.

The pilot's eyes are his most effective lifebelt when he gets ready to land. If they're in first class condition, he needn't worry about their failing him in a pinch. Regular check-ups are essential. Once a year is sufficient for most civilian flyers. The eyes probably won't change yearly, but the check-ups discover deficiencies before they become serious. The changes occur gradually. We're often unaware of them until we're suddenly called upon to do something we haven't done for a long time. Then we feel rather sick inside when we find ourselves unable to do it. The private pilot should consult his eye specialist regularly. The Air Corps values its planes and pilots too much to risk their eyes letting them down. Its pilots are examined about once every six months.

The airman whose eyes have been pronounced satisfactory after a careful and thorough examination by a competent specialist, can rest assured he'll pass the toughest Army or Navy examination. But once your eyes have been approved and found satisfactory for flying, protect them. Then they'll protect you.

END

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How to Determine Range

(*Continued from page 51*)

When this is the case an imaginary curve is drawn between the next higher and the next lower curve. For example, if the value Wg/Wo were 1.13, it would rest between the curve for 1.10 and 1.15. It would be nearer to the 1.15 curve than the 1.10 curve for two reasons. First, because 13 is nearer 15 than it is to 10. This we can call the numerical reason. Second, we note that as the values of Wg/Wo increases, the difference between them decreases. In other words the higher the curves go the closer together they are, which would make curve 1.13 slightly closer to curve 1.15 besides the numerical reason. Remember that all curves begin at 0. The curve 1.13 discussed as an example is shown on the chart by a broken line.

With the above thoughts in mind an imaginary curve can be laid on the chart. The numerical reason will be the most predominant. The effect of the other reason will decrease with each higher curve, but can be seen with the eye within the range of curves shown on this chart. Such an imaginary curve, so plotted by the eye, will be practically as accurate here as the calculated one.

END

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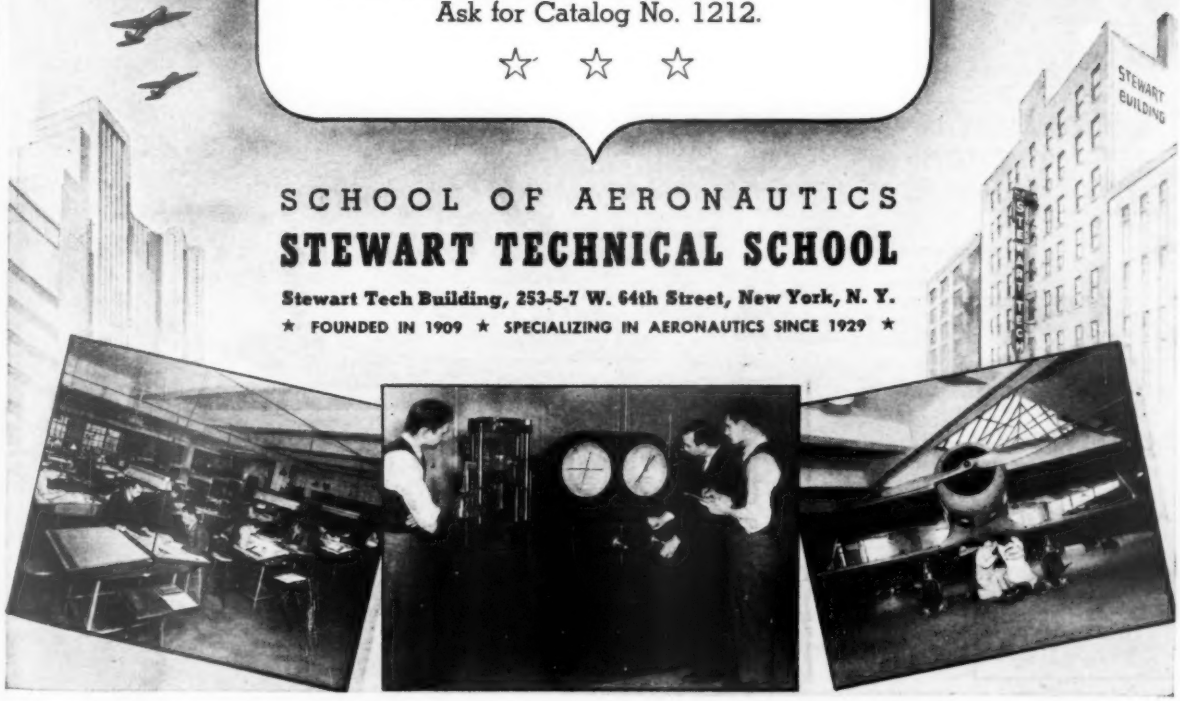

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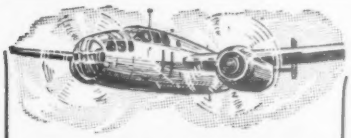

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Beryllium . . .

(*Continued from page 25*)

copper alloy increased the hardness of the material. Alloys of 70 per cent beryllium and 30 per cent aluminum have been rolled into sheets during experimental laboratory tests. Their greatest drawback has been that the product is too brittle and too expensive.

In 1931 various experiments were tried making beryllium-aluminum pistons which contained 70 per cent beryllium and 30 per cent aluminum. Although there were many difficulties with the casting of the pistons, one was produced for a *Wasp* engine which weighed 2.46 pounds, as compared with 3.63 pounds for the regulation piston. Cracks that developed in the piston because of the metal's brittleness after a gruelling trial run, discouraged further experimentation.

Principal uses for beryllium alloys in aircraft today include magneto springs, altimeter diaphragms, cowl springs and hinges, feed lines, governor drive housing relief valve seats, valve tappet roller bushings, gravity oil pressure relief valves, cam drives, gear bracket bushings and armor plate for protection of personnel and machinery.

Although beryllium is the lightest hard metal, so little of it is used in alloys that it hardly reduces the weight of the base metals. That is why skilled metallurgists have been trying so hard to successfully alloy beryllium with aluminum, thus increasing the strength and hardness of aluminum. If this alloy is perfected, it will mean that we can reduce the wing loading of a plane to approximately half what it is today by using the new metal where duralumin and other heavier metals are used. The metal will be substituted for copper and brass and even for beryllium-copper where that metal now is used in airplane construction. Thin sheets of beryllium-aluminum will provide stronger and much lighter covering material for wings and fuselages. Planes will be covered with armor made from such alloys, thus protecting crews and vulnerable parts of the plane. The lightening of the craft resulting from the use of beryllium-aluminum alloy, will result in increased speeds and much longer range due to the fact that the craft can be loaded much heavier.

The following table shows the comparative tensile strength of beryllium alloys now in use and the tensile strengths of other metals used in aircraft structures in pounds per square inch:

Beryllium contracid — two per cent beryllium and 98 per cent nickel	300,000 lbs.
Beryllium-nickel, two per cent beryllium and 98 per cent nickel	260,000 lbs.
Beryllium-copper, two per cent beryllium and 98 per cent copper	185,000 lbs.
Beryllium-cobalt-copper, small amount of cobalt	110,000 lbs.
Monel metal (a nickel-copper alloy)	125,000 lbs.
Phosphor-bronze (contains five per cent tin)	100,000 lbs.
Stainless steel	90,000 lbs.
Silicon bronze	90,000 lbs.
Brass	70,000 lbs.
Structural steel	60,000 lbs.
Duralumin	53,000 lbs.

It is the opinion of aviation authorities that if a reasonably priced beryllium-aluminum alloy, produced in quantity, could be obtained it would immediately take the place of duralumin in aircraft structures, because of its great strength and lightness.

The price of alloying beryllium with other metals is very high. For instance the cost of beryllium-copper in 1934 was $25 per pound. This increased to $30 per pound in 1936, dropped to $23 per pound in 1937-38 and in February 1939 the price was $15 per pound, still far higher than the price of duralumin.

At a recent Congressional hearing, Rep. B. Carroll Reece of Tennessee reported that Germany was further advanced in the beryllium industry than America; that Japan was actively in the market for beryllium-bearing ore and that Italy was buying and storing large quantities of beryllium producing ore.

According to Congressman Reece, Germany has a $10,000,000 plant housing its beryllium industry. Other kindred activities are carried on under this same roof, activities needed in the processing and refining of the metal for commercial uses. The Germans are using a special beryllium alloy bushing which has never failed and which is being produced in such large quantities that it is indicated she may soon be producing super-airplanes.

Why haven't we done more about it? There are basically five reasons for there being so little known about beryllium alloys in this country: the control of basic patents by the Germans, price fixing by local producers, high cost of experimentation, high cost of beryllium alloys, lack of Government interest.

When Gahagan first introduced his beryllium alloys in early 1929, he learned that Siemens & Halske, a German firm, held basic patents on the idea. He went to Germany to obtain licenses to manufacture beryllium alloys. (Under wartime emergency all foreign held patent rights in this country can be confiscated by the Government).

Under pressure of our national defense program, experimentation with beryllium-aluminum alloys is progressing more rapidly. It still hasn't reached a stage where there has been produced a successful product that can be manufactured in quantity at a reasonable price

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figure. The war may both retard and bring out further experiments. Need for duralumin and aluminum in plentiful quantities for airplanes that are needed now may lessen the interest in a new untried metallic combination. On the other hand experts know that beryllium-aluminum alloy would be a great boon to aviation, but it may be reserved for tomorrow's airplanes.

END

'Cooked' Craft

(*Continued from page* 66)

absorbers. A single curvature windshield is used, meaning that the plexiglass needs no forming necessary with a double-curvature windshield.

The ship's cabin is wide and roomy. Entrance is through a wide up-turning door on the right side, conveniently located to both front and rear seats. The four seats accommodate pilot, co-pilot and two passengers. Both front seats are adjustable for leg length. Auto-type rudder pedals come through the front wall of the cockpit. A hand brake engages the rudder pedals with wheel brakes instead of the rudders. The fuselage is as clean as a whistle clear to the tail. Fuel tanks are located in the wings. Vertical fuel indicators are mounted atop each engine nacelle and can be read easily from the cockpit.

Martin Jensen and Arthur Draper, former Navy pilot, the only pilots who have flown the Langley so far, are pleased with its performance. When the 90 h.p. Franklins are used, the Langley can hold her altitude with full load on one engine. Single engine service ceiling would be 8,000 feet. One engine performance is satisfactory. The landing speed, 46 m.p.h., is slow enough not to need flaps.

If the choice of twin 65 or 90 h.p. engines seems odd, there is one logical reason for Langley's decision to build this type of an airplane. Consider that two 65 h.p. engines provide a total of 130 h.p. for a $700 cost. But one 130 h.p. engine costs $1,000 plus. Likewise, two 90 h.p. engines give 180 h.p. for $950 while a 180 h.p. engine costs $1,500.

So far we've stayed on the credit side of the ledger for plastic plywood construction. Wood has undesirable as well as desirable characteristics. Under compression mahogany compares favorably with aluminum in equal strength-weight ratios. Wood, for the same strength, has a much thicker cross section than the comparable metal piece. Thin sheet metal will buckle under compression but wood, being thicker, has greater local strength to resist buckling. But wood compares poorly with metal under shear and bearing. Where four large bolts would be sufficient to attach the outer wing panel on an all-metal airplane, approximately 20 small bolts are needed for a wood wing. Plastic planes are most promising in the lighter categories. Large airplanes remain in the realm of metal, although some plastic proponents believe that ships as large as a DC-3 can be satisfactorily built by their method.

The Langley group has faith in the future of molded plastic plywood aircraft. While the first ship is being groomed to shed its "X" classification, another job already is well under way. Ninety h.p. Franklins will replace the smaller 65's used on the first job. Neither of the ships has been given its ATC rating, but CAA tests on the 65 h.p. ship are to be run soon.

Heading the Langley corporation is Caleb S. Bragg, president and World War flyer; and Vice Presidents Arthur Draper, Daniel Sickles and Harold Strotz. W. Horace Schmidlapp is treasurer. Directors are Martin Jensen and John P. V. Brennan. Lawrence N. Smithline who left Martin to be Langley's structural engineer.

What is the future of the molded plastic plywood process? At the moment, the sky is the limit. In addition to such commercial applications as complete boat hulls, pontoons for bridges, automobile bodies and prefabricated houses for defense centers, Langley foresees the molded process being adapted for the construction of military glider transports, commercial and private airplanes and even for airliners and troop-carrying transports.

END

Our Warplanes . . .

(*Continued from page* 68)

had any serious trouble with either of them. The B-24's are making non-stop flights across the Atlantic both ways every week. Recently 20 B-17's made the trip to England. About six months ago a flight of 21 *Flying Fortresses* flew from Oakland, Cal., to Hawaii in record breaking time.

Under actual combat conditions in Europe, the B-17's are proving to be superior fighting planes. The British are using the ships effectively at altitudes of 30,000 to 40,000 feet. At these heights the planes are out of range of Nazi antiaircraft guns. Above 32,000 feet, the B-17 can outclimbed any fighter plane in Europe. German planes have been known to attack at altitudes up to 32,000 feet, but above that the best Nazi fighters can't touch the four-engined American-built bombers.

All the new bombers being produced here are being equipped with the latest power-driven gun turrets. The turrets are mounting .50 caliber machine guns to replace the original .30 caliber guns. The .50 caliber shell will pierce one-half inch armor and is effective against any armor plating now in use on European craft. In addition, our large bombers are all equipped with new superchargers, developed by the Army Air Corps, which make possible the high altitude operations. Regarding the .50 caliber firepower, I have seen these high-powered shells during fire tests pierce the quarter-inch armor, originally used in our planes, as if it were so much cheese. The .30 caliber bullet is stopped by this armor. Today all our fighting planes are being equipped with standard .50 caliber guns.

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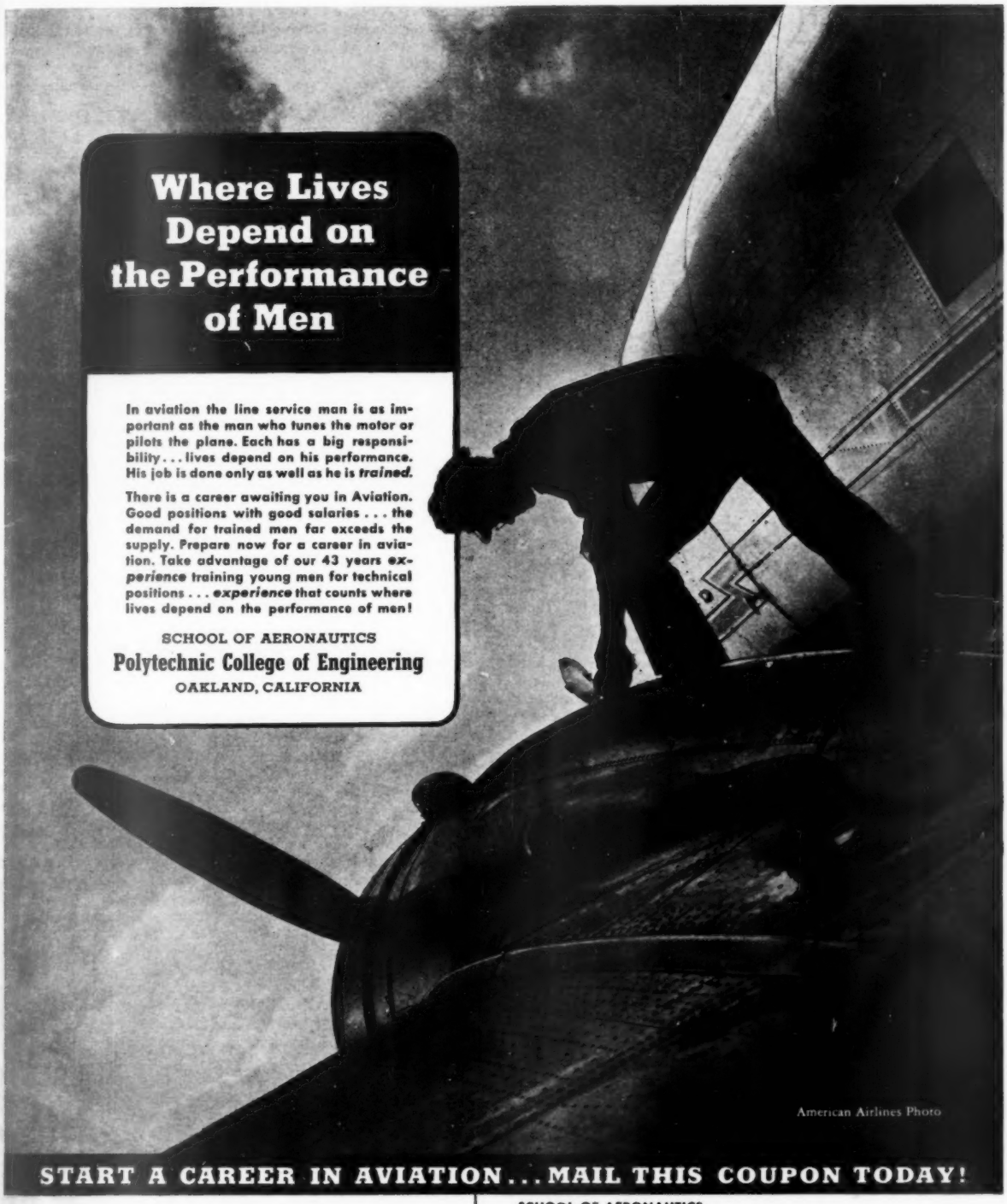
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For the past several weeks at Wright Field we have been conducting evaluation tests with four types of British airplanes, a Vickers *Wellington* bomber, the Boulton Paul *Defiant*, Hawker *Hurricane* and Supermarine *Spitfire* fighters.

Tests have shown that the *Spitfire*, the best of the foreign fighters, compares with our own Curtiss P-40 up to altitudes of 15,000 ft. Above 15,000 ft. the performance of the P-40 falls off and the *Spitfire* is more effective. But the P-40 is not our latest airplane. Lockheed's P-38 and the latest air-cooled Republic P-47 are far superior.

The *Wellington* night bomber is a plane apparently designed for heavy, slow work and its performance figures in no way compare with any of our American bomber types, which are of a later design. English *Hurricanes* are much slower than the *Spitfire*. But the *Hurricane* is a highly maneuverable plane. The *Defiant* two-place fighter has about the same speed as the *Hurricane* and, in general, the same performance figures.

Performance figures on the Messerschmitt Me-109, the standard German fighter, and all available testimony indicate that it is inferior to the British *Spitfire*. Our engineers are constantly studying German equipment which is sent over here by the British with a view to adopting any features which are desirable. We are not missing any bets. If the Germans have something better than ours, we can make it as well as they can.

There is no question in our minds that we are now getting the product in our planes that we have been aiming at. The "bugs" have been ironed out. We're waiting for the new factories to go into production, for more skilled labor to be introduced from the vast organizations of training schools, for more pilots. But each phase is being completed at an astounding pace. Monthly plane production is steadily increasing and there is no reason to doubt that by the end of next year (1942) we will be producing at the rate of 50,000 planes per year, set as a goal by President Roosevelt a little more than a year ago. Then we will have the air power that we have been seeking. In every phase of aviation, America will have the superiority in the air that is so essential to ultimate victory.

END

Preparedness Tech

(*Continued from page 27*)

ecutives, that it was the finest program of its kind in the country.

Cornell's reaction was rapid. Its College of Engineering now offers three free follow-up courses involving the mechanics of airplane structure. One course is a continuation of a course offered at Burgard.

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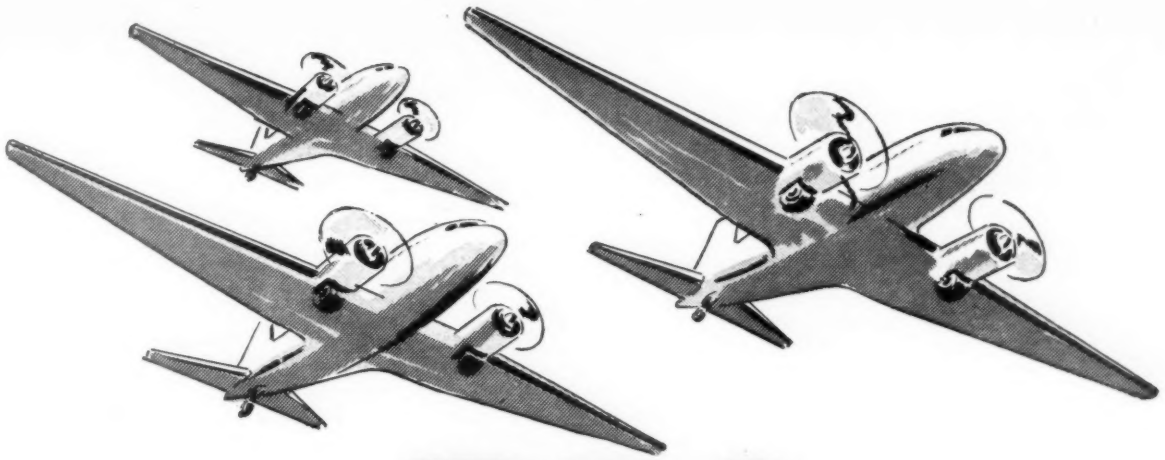
Industry has co-operated by placing 129 instructors in Burgard who not only teach defense students but also give intensive three-week courses to instructors chosen to teach in the newly-established state training centers. These men, who teach aviation from long plant experience, came from various aircraft factories. Curtiss supplied 54; Bell, 23; and 48 came from other plants throughout the country.

Quick to recognize the part Burgard is performing in defense the Federal Government has provided funds to throw open all the Buffalo schools and many others throughout the country, enabling them to teach allied trades. More than 10,000 men now jam classes in six Buffalo schools, teaching 78 trades. The skills of these graduates are passed upon by 300 experts gratefully donated by private industries.

As Kamprath aptly put it: "We have smashed the bottleneck which limited the supply of trained men to defense industries. We have cut all red tape in establishing these short training courses which produce a continual flow of men needed in defense specialization. When local industry calls for 100 riveters, we send as many capable men as we have on hand, then proceed to train the rest in double-quick time. When they call for 50 welders, we accommodate them in the same manner.

In return industry has co-operated admirably. Bell Aircraft supplied us with the fuselage of an *Airacuda*, Curtiss with the wing of a *Hawk*, the counterpart of which the British flyers have named the *Tomahawk*. Industry has sent us skilled technicians to act as instructors and teachers.

Currently we are trying out a new plan. Instead of men working on useless pieces of scrap in shoprooms, our classes will now work on a production plan, producing regulation plane parts—exact copies of the parts given us by in-



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dustry. The newly established centers such as Utica, Syracuse, Olean and others can have actual plane parts for student instruction. These parts are made by our students and will undergo the same tests by plant experts as are made in the factories.

With the key to the building practically thrown away, 52 teachers instruct 1,300 students in the day sessions. At 4:30 p.m. the first group of the current enrollment's 4,693 national defense students begin to fill the shop rooms in which 227 faculty members hold sway. These groups go into production for two hours, until the second group finishes at 9:30 p.m. At 10:30 p.m. the all-night shift arrives to work and study until 6:30 a.m. These students comprise WPA men and youths selected for training by the New York State Employment Department. Additional classes are conducted for NYA enrollees.

One of the few schools in the country able to emphasize the practical angle of aviation, Burgard boasts a lofting department for the layout of full-size plane parts. So expert is the instruction in the various 10-week courses that some men, showing greater ability than others, are turned out as skilled workers in six weeks. So far, there is no known instance where a Burgard man has been fired for inefficiency.

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END

Stop Japan Now!

(*Continued from page* 64)

finesse to coordinate mentally exactly what they themselves and the airplane are going to do.

I had never given much thought to the physical condition of Japanese flyers until the day I received a cabled request from a Sydney, Australia, newspaper. The paper asked whether the increased vertigo of Japanese aviators at altitudes could be attributed to the lack of eating beef. This was a new type of request for a foreign correspondent and I was interested in the follow-up:

Basically, the Japanese diet is raw fish, sea weed, bean curd and uncooked vegetables. Naturally such food is not substantial for anyone in active work. I found that the Japanese navy in particular had had to establish a special diet for its aviators, based on a combination of rich vitamin-producing Japanese and American-style food. (The Australian inquiry was a bit mercenary; if it could be established that vertigo in Japanese flyers was increasing, an enterprising Australian beef salesman expected to open a new market.)

So Japan's downfall will be the poison of her own reasoning to the effect that she is invincible. The answer in dealing with such a nation is to take Vladivostok, Dakar and Martinique—and do the arguing afterward. If we find we do not need the bases, we can hand them back. A hermitage empire, helpless, isolated, Japan cannot maintain a major military assault. Her present leaders are blind if not cognizant of the high industrial mortality from airplane attacks.

But as the late ambassador to Washington—Hirsohi Saito—remarked: "Japan has crazy men."

END

NIPPONESE STATISTICS

The Japanese army used its first balloon in 1877.

In one of many internal wars between 1831 and 1859, a Japanese hit on the plan of sending a man up on a kite to observe the enemy's position.

The Japanese claim that, in 1894, one of their people made the first model of a machine resembling an airplane.

Japanese stories relate that, once upon a time, a man who invented a flying machine fell into a cherry blossom party being given by a feudal lord. The date of this catastrophe is not given but it probably is about 1825.

Japan today has 35 airports. Commercial airlines cover about 10,500 miles. Commercial lines have four 21-passenger Douglas DC-3's and several 10-passenger Lockheeds. Passengers number about 25,000 a year.

Tokyo is 587 miles from Sapporo, which is the northernmost branch of the civil air service, 1,400 miles to the end of the line in Manchuria and 2,034 miles to Tientsin. Hanoi, Indo-China, the latest acquisition, is about 3,000 miles.

Japanese plane losses in China have been heavier than generally believed. In four years they have used up, had shot down and crashed in accidents about 3,100 planes. The Chinese have lost, according to Japanese figures, 1,985 planes.

The first Japanese to fly a plane was Capt. Kumazo Hino, who flew a German monoplane December 14, 1910, to an altitude of 99 feet, using a 24 h.p. engine and reaching a speed of 36 m.p.h. Five days later another Japanese piloted a Henri Farman, two-seater, with a 50 h.p. Gnome engine, at 41 m.p.h. Japan's greatest aviation accomplishment was the flight of a home-made plane in 51 hours from Japan to Europe, using a Nakajima 550 h.p. engine and at a maximum speed of about 312 m.p.h.

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From Headquarters

(*Continued from page 36*)

A.E.F.) tops the roster. Pretty soon now, operations officers (the men behind the stick) will be consulted on all questions of design, operations, training, tactics, organization, development and production. This should have been done long ago.

Even Gen. W. E. Gilmore, retired, is back in the capital doing his bit for aviation. Gen. Mason M. Patrick, retired, former chief of the Air Corps, is ever ready to lend a helping hand by way of advice and often is called upon to do so.

An encouraging factor down here during the emergency is to find successful business men doing well as commissioned officers. It bespeaks understanding on the part of the regulars, who give them a chance and it shows the value of a business career in dealing with the complex problems of modern war. Maj. Eugene Gillespie, specialist reserve corps, is the former commander, Aviators Post No. 743, American Legion, New York City. He draws upon his experience as a Wall Street man in solving strategical airway extension programs or any other out-of-the ordinary job of hemisphere defense.

At last public opinion will prevail and a grand gentlemen-soldier and flyer will be vindicated by his countrymen. The rank of brigadier general is about to be given the late William Mitchell, military aviation's greatest crusader. Sen. Alexander Wiley from Mitchell's home state, Wisconsin, introduced Senate Joint Resolution 109 and Rep. John McCormick of Massachusetts filed a similar resolution in the House. FLYING AND POPULAR AVIATION is assured that these will meet with the approval of the War Department. That means it will be a law. It carries no back pay and therefore is no burden on the swamped taxpayer. Had Mitchell been heeded in 1923, our law-makers would probably be more generous for it is estimated that the separate air force he advocated would have made the Goering *Luftwaffe* impossible of birth or growth. He would have saved this country at least 20 billions annually. Too bad, Uncle Sam is so hard put these days that he cannot recognize the late general's emoluments as properly due and payable.

"What's the use in saving two hours by plane over train coming here from New York if it takes me 54 minutes to get my suit-case from the plane to the taxi," a disgruntled passenger remarked recently at the new Washington municipal airport.

Everyone was mad—even the pretty hostess.

Several endless belt arrangements, like escalators, were overlooked by Sumpter Smith when he laid out the air conditioned terminal here. That goes for Mayor La Guardia's North Beach, Long Island airport, too.

Some folks down here are kicking about sending our fighting planes to England at the rate of 400 per month. What would they say if they knew England in turn is flying fully equipped front-line aircraft to Russia at a pace of 200 per week?

This is an interesting place to be in war days. Recently I read over the diary of a Rumanian officer, Mihar Olteanu, who was fighting on the side of the Nazi as an ally. Daily he wrote of the terrible fire from Russian planes.

"We are disgusted and hopeless," he scribbled on one page.

Poor, deluded, misguided dupe, he wondered each day why the Nazis always "held his coat," and sent the Rumanian boys out ahead and made them cross the Dneister against Russian dive bombers by the score.

"Truly cannon fodder," he wrote. "The Germans seem to have no regard for us."

He was killed August 23, 1941 by a Russian airman.

END

Ads in the Sky

(*Continued from page 30*)

Other companies swear by the Waco. Whatever the type, though, it must have at least 200 hp.

Letters used in Midwest's service are designed in such a manner that they flatten out when in the air eliminating too much drag on the plane. The eight-foot letters are nine to 12 inches in width at all parts. Red cotton cloth, of which they are made, has greater visibility in the sky than black. Each letter has its own bamboo pole and eight permanently attached tapes of heavy webbing. At the end of each tape is a swivel-mounted spring clip or a metal eye. The tapes are of the exact length required to space the letters evenly. Tape at the top of letter "A", for example, is much longer than that at the bottom, while those at the top and bottom of the letter, "I" are the same in length.

Letters are block style with no serifs, in order to contribute to the all-important high visibility. Tapes and bamboo poles are invisible to observers on the ground—forming an orderly arrangement of distinct letters etched against the sky.

When not in use, each letter is rolled around its own bamboo pole and hung along a wall. Midwest keeps 400 to 500 letters in stock. Often one letter appears many times in a sign. Letters are damaged easily and consequently new ones needed for replacements. Spring clips and metal eyes permit rapid assembling of the signs.

Once arranged, the lead-off pole is attached to the letter nearest the plane. This pole may be of lightweight metal or sturdy bamboo. To the pole are attached lead ropes. These ropes run to special mounts on the plane, the jaws of which are releasable from the cockpit.

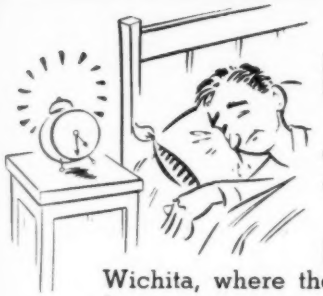
When a banner must be released away from the airport it is difficult to recover. Letters cost $8 apiece and banners can carry 32 of them. Pilots who have too much trouble through lack of skill, aren't liked by aerial advertising companies.

Weather restrictions impose the severest limitations on banner towing. If a heavy banner is being hauled around in the air, any rain that's apt to soak the cloth adds unwelcome weight.

END

Wake Up, Fella!

THINGS ARE HAPPENING



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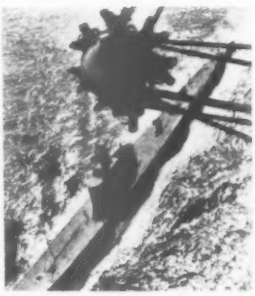

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Airy Chat

(*Continued from page 4*)

the engines of the new XPB2M-1, later sat out alongside a runway watching a Martin test pilot put a B-26 through its paces. Then, the evening plane got us to New York in time for dinner.

Spent the next day lining up material for future issues, with Photographer Hans Groenhoff and Writers Bill Winter, Ed Lawson and Kurt Rand. Lunch with Mark Nevils of Curtiss-Wright, dinner (two pastrami sandwiches!) with Bill Van Dusen of Pan American Airways. Next morning dashed out to Pan American's marine base at LaGuardia Field to climb around the *Dixie Clipper*, then over to the terminal in time to lunch with Ed Doherty before catching the noon plane to Buffalo. After several hours at Bell Aircraft's new Niagara Falls plant (where they've got six separate assembly lines for *Airacobras*), and a scary ground-strafing demonstration by Test Pilot Jack Woolams with an *Airacobra*, we headed for the evening airliner for Detroit. Bell's Walt Bonney (who once was an F&PA correspondent) tucked us aboard. Then the weather got bad and, after two hours and 38 minutes of flying over Canada and Detroit, we landed again—at Buffalo. Soon after we landed, another airliner returned, this one from Pittsburgh. One of the passengers decided to stay overnight in Buffalo, so the two of us piled into a cab and rode into the city. En route, we discovered our companion was RAF Wing Commander E. R. Mole, for whom we had hunted in Washington a few days past but could not locate.

Off to Detroit next morning. Spent the evening with Bob Hall, Detroit *News* aviation editor and an F&PA writer. Next morning we landed back in Chicago, a week and 3,000 miles after that Saturday night we tried to go to bed at home.

• • •

WHAT'S-IN-THE-WIND. Jimmy Doolittle, they tell us, recently visited the RAF in the Mediterranean. One of our supercharged B-17's has climbed to nearly 45,000 feet. When Henry Ford goes into production on Consolidated B-24's, his version will have soy bean plastic wing tips. The CAA has been advertising for aircraft assemblers for Africa. One of the country's biggest manufacturers is building 4,000 foot runways on his airport for "a 1944 model" already on the drawing boards. Aeronautical products worth $283,795,865 were shipped from the U.S. during the first six months of 1941, compared with $138,387,090 worth during the same period of 1940. The Martin *Baltimore*, successor to the famed *Maryland*, is said to be armed with more than a dozen guns. There were 2,296 airports of all classes in the United States as of September 1. U.S. radio ranges total 298, including eight in Alaska and two in Hawaii. The CAA just turned down a German application to start a zeppellin airline between Germany and the U.S.—it was filed October 24, 1938. It used to be that an airline was doing good to average a passenger load factor of 50 per cent of

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LUGER Auto. Pistol with 8" machined barrel. 1.90
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These beautiful kits are complete in every detail and made of the best basswood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.
GUN MODEL CO.
Dept. KA-12, 2908 N. Nordica Ave. Chicago, Ill.

total seats available; today the average for the entire country is between 65 and 70 per cent. There is a new model of the Navy's PBM coming up.

Army men at Wright and Patterson Fields say the Russian pilots now there are some of the world's best. Biggest problem at Patterson Field is with traffic control—in English—over the Russians. Solution is to paint all ships being flown by them with large white crosses. Now traffic control operators spot approaching white-crossed ships and warn all pilots who can understand English to stay clear until the Russians have landed. Continental has developed a 1,750 h.p. liquid-cooled engine that may go into new Curtiss P-40's. One man being discussed for the Army's new press relations bureau at Wright Field is Dick Kirschbaum, Newark *News* aviation editor and F&PA correspondent, Maj. Fred Dent, author of a gliding article in a recent F&PA Air Services Section, was in Moscow at last reports. Curtiss may try a tricycle gear on its P-40. Already "in the works" are plans for the Boeing B-17F; mostly more guns.

There is an interesting cargo plane in the offing: welded steel, plywood wings and fuselage, hinged nose, twin-engined. Wings may be made in Grand Rapids furniture factories. It will have tricycle gear. Several airlines are learning all about big four-engined landplanes today by sending crews to fly in British and American bombers. There is a scale model of a Martin PBM-1 in the lobby of the Navy Department, with one torpedo hanging on each wing, just under the engines. Germany is said to be operating two-fifths of her pre-war airlines. Remember several months ago when we said the British soon may begin ferrying fighting planes to England by air, via Greenland and Iceland? Well, don't be surprised when . . .

* * *

A birdie told us. MAX KARANT.

END

Letters

(*Continued from page 6*)

on emergency landings that mentioned that it was a good idea to know the stalling speed. . . . I believe it is more important to know the best gliding speed. . . . I believe a man should be "gliding conscious" rather than "forced landing conscious.". . .

H. H. BROWN

Lititz, Pa.

Favors Mech Feature

Sirs:

Like Reader Summers (Letters, August issue), I think it is an excellent idea [Summers suggested a feature similar to "I Learned About Flying from That," to deal with mechanic's experiences] . . . any hints or suggestions that the experienced mechanic could pass on would help . . .

GEORGE K. MALLORY.

Amherst, Mass.

END

FLYING and POPULAR AVIATION USED PLANE LISTING OF AUTHORIZED AIRCRAFT DEALERS

The world's largest selection of used aircraft is listed in this special reader service section. Fine used airplanes in good licensed condition, some with hardly any time at all, many with but a few hours since overhaul. Each plane selected by an expert who has the mark of factory approval due to the fact he is an AUTHORIZED AIRCRAFT DEALER. These are ships you can buy to fly. Select any one of them, they are all real buys, and can be purchased just as you purchase your car.

ALL AIRCRAFT LISTED ARE LICENSED

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
AERONCA					
Laddie Hamilton, c/o Dixie Coaches, Tuscaloosa, Ala.	Chief	Cont. 65	95 hr.	Never	$1950
Dwight Rohn, 1300 Monroe Street, Beardstown, Illinois	Super deluxe Chief	Cont. 65	275 hr.	None	1750
Edwards Flying Service, Inc., Flushing Airport, Flushing, L.I., N.Y.	65 CA	Cont. 65	300 hr.	Never	1750
Ashcraft Bro's Flying Service, Munic. Arpt., Lawrence, Kansas	Chief	Cont. 65	651 hr.	Never	1750
United Aero Corp., P. O. Box 222, San Antonio, Texas	Super Chief	Lyc. 65	317 hr.	317 hr.	1550
Leeward Aviation, New Kensington, Pa.	Chief 1939	Cont. 65	60 hr.	New	1450
Lenhart Flying Serv., Arpt., Marion, Ind.	TF	Frnkln. 65	12 hr.		1395
Morristown Fly. Club, Morristown, Tenn.	Chief '40	Lyc. 65	362 hr.	No	1375
Mountain States Aviation, Inc., 3800 Dahlia, Denver, Colo.	Chief	Cont.	980 hr.	Just 450 hr.	1350
Cincinnati Arcft. Serv., Lunken Arpt., Cinn., O.	TL 65	Lyc. 65	285 hr.	Never	1300
Lane Air Service, Albany, Ga.	Chief Deluxe	Cont. 65	375 hr.	Recently	1300
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida	Tandem Trainer	Lyc. 65	280 hr.	No	1300
C. W. Peterson, Munic. Arpt., Salina, Kans.	Chief	Cont. 65	350 hr.	Never	1250
Lenhart Flying Serv., Arpt., Marion, Ind.	TL	Lyc. 65	192 hr.		1250
Inter-City Avia., Inc., Boston Munic. Arpt., E. Boston, Mass.	Chief	Lyc. 65	825 hr.	210 hr.	1250
Pierce Flying Serv., Box 894, Eureka, Calif.	65-TC	Cont. 65	650 hr.	100 hr.	1250
Tred Avon Flying Serv., Inc., Easton, Md.	Trainer	Lyc. 50	236 hr.	No	1238
Richmond Air Transp.,Byrd Arpt.,Richmond,Va.	Chief	Cont. 50	510 hr.	30 hr.	1200
St. Louis Flying Serv., Lambert Field, Robertson, Mo.	KCA	Cont. 50		Recently	1175
C. W. Peterson, Munic. Arpt., Salina, Kansas	Chief	Cont. 65	349 hr.	Never	1200
Dwight Rohn, 1300 Monroe Street, Beardstown, Illinois	Chief	L.A. 65	850 hr.	100 hr.	1195
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	TL	Lyc. 65	150 hr.	No	1150
Jenkins Air Serv., Inc., Munic. Arpt., Rochester, N. Y.	TL	Lyc. 65	200 hr.		1150
Springfield Avia. Co. Munic. Arpt., Springfield, Illinois	Tandem Tr.	Frnkln. 60	303 hr.	No	1150
Northern Air Service, Grand Rapids Airport, Grand Rapids, Michigan	C65	Cont. 65	1275 hr.	250 hr.	1100
Lexington Fly. Serv., Inc., Lexington, Ky.	Chief	Frnkln. 50	281 hr.	Topped	1100
Art Whitaker, Swan Island Arpt., Portland, Oregon.	Trainer	Lyc. 65	700 hr.	500 hr.	1075
Northern Air Service, Grand Rapids Airport, Grand Rapids, Michigan	TL	Lyc. 65	650 hr.	100 hr.	1050
United Aero Corp., P.O. Box 222 San Antonio, Texas	Chief	Lyc. 50	550 hr.	550 hr.	1025
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	TF	Frnkln. 60	565 hr.	160 hr.	1005
Richmond Air Transport, Byrd Arpt., Richmond, Va.	60TF	Frnkln. 60	355 hr.		1000
Boulevard Airport, Inc., Roosevelt Blvd., Philadelphia, Pa.	Trainer	Lyc. 55	472 hr.	Never	950
Edwards Flying Service, Flushing Airport, Flushing, L. I., N. Y.	50C	Cont. 50	750 hr.	150 hr.	950
Lenhart Flying Serv., Arpt., Marion, Ind.	TF	Frnkln. 60	365 hr.	310 hr.	950
Midwest Flyers Lakeside Arpt., E. St. Louis, Ill.	Trainer	Frnkln. 60	550 hr.	Jan. '41	950
R. D. Finefrock, Box 301, Tyler, Texas.	Chief '38	Cont. 50	500 hr.	Just relic.	950
Tri-State Aviation Corp., Cincinnati Arpt., Sharonville, Ohio		Frnkln. 60	511 hr.		940
Edwards Flying Service, Inc., Flushing Airport, Flushing, L.I., N.Y.		Cont. 50	750 hr.		900
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	T	Lyc. 65	850 hr.	150 hr.	900
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Ind.	Le 65	Lyc. 65	1100 hr.	950 hr.	900
Jenkins Air Serv., Inc., Munic. Arpt., Rochester, N. Y.	TF	Frnkln. 60	620 hr.	Major 576 hr.	900
Southern Arwys. Sales Co., Munic. Arpt., Birmingham Ala.	'38	Cont. 50	300 hr.	290 hr.	900
St. Louis Flying Serv., Lambert Fld., Robertson, Missouri	KCA	Cont. A-50	974 hr.	5 hr.	885
C. W. Peterson, Munic. Arpt., Salina, Kansas	LB	LeBlond 90	575 hr.	200 hr.	880
United Aero Corp., P.O. Box 222, San Antonio, Texas	Trainer	Frnkln. 60	1250 hr.	200 hr.	875
Jones Fly. Serv., Sullivan Av. Arpt., Cols., O.	K	Frnkln. 50	680 hr.	Fact. 150 hr.	875
Tri-State Aviation Corp., Cincinnati Arpt., Sharonville, Ohio		Frnkln. 60	605 hr.		850
Southern Arwys., Mun. Arpt., Birmingham, Ala.		Cont. 50	360 hr.	350 hr.	850
Tri-State Aviation Corp., Cincinnati Arpt., Sharonville, Ohio	TF	Frnkln. 60	952 hr.	164 hr.	$775
Howard G. Mayes, P.O. Box 2104, Huntington, W. Va.		Cont. 50	729 hr.	Never	750
Portland Flying Serv., Inc., Municipal Airport, Portland, Maine	Chief Struts	Edo Floats			700
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	K	Cont. 40	750 hr.	Just	650
Boulevard Airport, Inc., Roosevelt Blvd. Philadelphia, Pa.	K	40	162 hr.	Never	650
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Calif.	K	Aeronca 40	837 hr.	59 hr. since	600
Aero-Ways, Inc., Munic. Arpt., Cleveland O.	K	Aeronca 40	328 hr.	Just relic.	600
St. Louis Flying Service, Lambert Field, Robertson, Mo.	K		1112 hr.	130 hr.	550
Hawthorne Flying Service, Municipal Airport, Charleston, S. C.	K 40		583 hr.	583 hr.	500
ARROW SPORT					
Roy R. Taylor, Meacham Field, Fort Worth, Texas		Ford V-8 75	233 hr.	Just	550
Aero-Ways, Inc., Munic. Arpt., Cleveland, O.	Sport	V8	520 hr.		525
McInnis Aviation Service, Inc., Municipal Airport, Minneapolis, Minn.	Converted	V8 85 h.p.	229 hr.		500
BEECHCRAFT					
E. W. Wiggins Airways, Inc., Boston Municipal Airport, East Boston, Mass.	NC	Jacobs 285	46 hr.		6500
Colorado Aviation Company, 426 U.S. Nat'l Bank Bldg., Denver, Colo.		Jacobs 285	700 hr.	160 hr.	6000
Marion-Parkinson, Central Ia. Aircraft Sales.	B-17-14	Jacobs 225	920 hr.	40 hr.	3450
BELLANCA					
Art Whitaker, Box 3820, Portland, Ore.	Cruisair	Ken Royce 90	95 hr.	None since top	3500
BIRD					
Edwards Flying Service Inc., Flushing Airport, Flushing, L. I., N. Y.		125 Kinner		75 hr.	1200
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida		Kinner 90 h.p.	1500 hr.	250 hr.	795
CESSNA					
Tri-State Aviation Corp., Cincinnati Airport, Sharonville, Ohio	Airmaster	Warner 145	265 hr.	255 hr.	4850
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	C-145	Warner 145	475 hr.	ship be'g majored	2950
Leon D. Sherrick, McKinley Airport, Canton, O.		Wright J-6-7	600 hr.	100 hr.	1150
CULVER					
Tri-State Aviation Corp. Cincinnati Arpt., Sharonville, Ohio		Cont. 75	25 hr.		2000
New Mexico Flying Serv., Box 67, Clovis, N.M.	LCA	Cont. 75	92 hr.	No	1850
CURTISS ROBIN					
Safair, Inc., Roosevelt Field, Mineola, N. Y.		Chall. 185	1273 hr.	538 hr.	885
Johnson Fly. Serv., Inc., Missoula, Mont.	4 place	Chall. 185	800 hr.	2 hr.	875
Red Bank Airport, Inc., Red Bank, N. J.		Chall. 185	575 hr.	162 hr.	650
DAVIS					
Dethloff Flying Service, Euclid Avenue Airport, Willoughby, Ohio		LeBlond 90	235 hr.	50 hr.	2000
Capt Arthur J. Davis, East Lansing East Lansing Michigan		Warner 125	137 hr.	None	900
ERCOUPE					
Brinckerhoff Flying Serv., Inc., College Park Airport, College Park, Maryland	415C	Cont. 65	550 hr.	15 hr.	1800

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
FAIRCHILD					
Northway Fly. Serv., Norton Fld., Columbus, O.		Warner 145	185 hr.	None	$6250
F. W. Schrom, Schram Airport, Berwyn, Maryland	24 4 PCLM	Warner 125	490 hr.	Just	4000
Thomas Metcalf, Toledo Mun. Arpt., Toledo, O.	24	Warner 145	356 hr.	Topped 306 hr.	3975
T. A. Colbertson, Medford, Oregon	246	Warner 145	800 hr.	350 hr.	3500
Jos. R. Higgins, Mozart Park, Wheeling, W.Va.	24	Ranger 145	790 hr.	10 hr.	2500
E. H. Brockenbraugh, Munic. Arpt., Charlotte, N. C.	24	Warner 145	350 hr.	Just	2395
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Calif.	71	Wasp SC-1 450 h.p.	3184 hr.	447 hr.	2000
John P. Hall, West Haven Arpt., West Haven, Conn.	24	Warner 145	348 hr.	Recently	1650
Art Whitaker, Box 3820, Portland, Ore.	24	Cirrus 100	1200 hr.	None since Major	1125
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	KR34	Wright J65 185 h.p.	700 hr.	16 hr.	1050
FLEET					
Johnson Flying Serv., Inc., Missoula, Mont.	9	Kinner 125	1200 hr.	100 hr.	1750
West Coast Aircft., L.A. Munic. Arpt., Inglewood, Calif.	2	Kinner 100		Just	1550
Brinckerhoff Flying Service, Inc., College Park Airport, College Pk., Md.	1	Warner 125	800 hr.	20 hr.	1300
Granite State Airways, Manchester Arpt., Manchester, N. H.	2	Kinner 100	1300 hr.	1125 hr.	1200
White Fly. Serv., Inc., Caldwell-Wright Arpt., Caldwell, N. J.		Warner 125	1090 hr.	6/40	1095
FUNK					
Island Crop Dusting Co., Airport, Caribou, Me.	75B		150 hr.	at 130 hr.	1300
Aircraft Unlimited, Roosevelt Field, Mineola, N. Y.	B	Funk 63	190 hr.	No	1200
KINNER					
Schneider Aero Serv., Chandler Fld., Fresno, Calif.	Sportwing	Kinner 125	1303 hr.	450 hr.	1105
Schneider Aero Service, Chandler Field, Fresno, California	Sportwing	B-5	1500 hr.	430 hr.	800
KITTY HAWK					
John P. Hall, West Haven Airport, West Haven, Conn.	B-5	Kinner 125	2300 hr.	15 hr.	1300
John P. Hall, West Haven Airport, West Haven, Conn.	B-5	Kinner 125	1825 hr.	30 hr.	1250
LAMBERT					
Al Guthrie, Stillwater Box 466, Stillwater, Okla.	90		800 hr.	5 hr.	650
LUSCOMBE					
Knox Flite, Municipal Airport, Knoxville, Tenn.	Phantom	Warner 145	221 hr.	11 hr.	3500
Falcon Aircraft Corporation, Los Angeles Municipal Airport, Inglewood, California.	Silvaire	Cont. 75	260 hr.		2650
Falcon Aircraft Corporation, Los Angeles, Municipal Airport, Inglewood, California.	Silvaire	Cont. 75	160 hr.		2650
Carl Evers, 247 Park Ave., N. Y., N. Y.	Silvaire 75	Cont. 75			2650
Carl Evers, 247 Park Ave., N. Y., N. Y.	DeLuxe Silvaire	Cont. 75	22 hr.		2450
W. F. Luke, Schenectady City Arpt., Schenectady, N. Y.	Silvaire 8.C	Cont. A.75	70 hr.		2400
Falcon Aircraft Corp., L.A. Mun. Arpt., Inglewood, Calif.	8A	Cont. 65	350 hr.		2200
C. W. Peterson, Munic. Arpt., Salina, Kansas.	8A	Cont. 65	110 hr.	Never	1950
C. W. Peterson, Mun. Arpt., Salina, Kansas.	8A	Cont. 65	100 hr.	Never	1950
Air Serv., Inc., Mun. Arpt., Denver, Colo.	8A	Cont. 65	84 hr.		1850
Midwest Fly. Serv., La Grange, Ill.	8A	Cont. 65 Dual	125 hr.	None	1850
W. F. Luke, Schenectady County Arpt., Schenectady, N. Y.	8A	Cont. 65	113 hr.		1800
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Mich.	8-A	Cont. 65	160 hr.	Never	1795
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Maryland	8B1	Lycoming 65	30 hr.	New	1790
Midwest Fly. Service, La Grange, Illinois	8A	Cont. 65	225 hr.	None	1700
J. L. Wells, 106 W. Main, Avon Park, Fla.	8A	Cont. 65	95 hr.	None	1675
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, New York		Cont. 65 Dual	213 hr.	No	1650
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Mich.	8-AJ	Injector	800 hr.	250 hr.	1650
Massey and Ransom Flying Service, P.O. Box 416, Fort Collins, Colo.	8-A	Cont. A65	1065 hr.	176 hr.	1600
Upton & Bowen, West Memphis, Ark.	8A	Cont. 65	300 hr.	50 hr.	1600
Midwest Fly. Serv., La Grange, Illinois	8B1	Lycoming 65	150 hr.	None	1600
Massey & Ransom Flying Service, P.O. Box 416, Fort Collins, Colo.	8A	Cont. A65	1019 hr.	96 hr. being overh'l'd	$1550
Massey & Ransom Flying Service, P.O. Box 416, Fort Collins, Colo.	8A	Cont. A65	1050 hr.		1550
Schneider Aero Service, Chandler Field, Fresno, California	8A	Cont. 65	1450 hr.	410 hr.	1550
W. F. Luke, Schenectady County Arpt., Schenectady, N. Y.	8A	Cont. 65	350 hr.	50 hr.	1550
Thompson Fly. Serv., Inc., Salt Lake City, Utah	8A	Cont. 65	753 hr.		1475
E. W. Wiggins Airways, Inc., Boston Municipal Airport, East Boston, Mass.	NC21559	Cont. 65	500 hr.	25 hr.	1475
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.		Cont. 65	250 hr.	No	1400
Ferris Thomas, Municipal Airport, Knoxville, Tennessee	8A	Cont. 65	530 hr.	30 hr.	1400
Knox Flite, Municipal Arpt., Knoxville, Tenn.	8B	Lyc. 65	517 hr.	Just	1400
Ferris Thomas, Mun. Arpt., Knoxville, Tenn.	8B	Lyc. 65	500 hr.	40 hr.	1350
Carl Evers, 247 Park Avenue, New York, N.Y.	8B	Lyc. 65	450 hr.	Never	1250
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.		Cont.	320 hr.	No	1100
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, New York		Cont. 50	374 hr.	Topped	1050
MONOCOUPE					
Fla. Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida		Warner 125	945 hr.	240 hr.	1250
Leon D. Sherrick, McKinley Arpt., Canton, O.		Warner 125	750 hr.	75 hr.	1200
St. Louis Flying Service, Lambert Field, Robertson, Mo.		Lambert R-266	1000 hr.	Unknown	885
MOTH					
Carl Evers, 247 Park Avenue, New York, N.Y.	Jan Hearse	Gypsy Major 130	New		2800
NEW STANDARD					
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Indiana		Wright J5	720 hr.	700 hr.	1100
Boulevard Arpt., Inc., Roosevelt Boulevard, Philadelphia, Pa.		Kinner 90	1500 hr.	700 hr.	700
PIPER CUB					
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4	Cont. 65 '40	70 hr.	None	2200
Madison Flying Serv., Route 1, Madison, Ind.	J4	Cont. 75	65 hr.		2000
St. Louis Flying Service, Lambert Field, Robertson, Mo.	Coupe	Cont. 75	100 hr.		1995
Seidner Flying Service, S.A.M. Airport, Bookwood Dr., Youngstown, Ohio	Coupe '41	Cont. 75	93 hr.	Never	1960
Piedmont Aviation, Inc., Municipal Airport, Winston-Salem, N. C.	1941	Cont. 75 Dual	185 hr.	85 hr.	1950
Stiles Motor Co., 260 Main St., Northport, N.Y.	Coupe J4A	Cont. 65	142 hr.	New	1900
L. L. Rupert, Box 446, Muskogee, Okla.	Coupe '40	Cont. Dual 65	155 hr.		1850
Philadelphia Skyport, Inc., Pier Three South, Philadelphia, Pa.	Seaplane	Cont. 65	151 hr.	Never	1825
L-H Air Serv., Inc., Hatboro Arpt., Hatboro, Pa.		Cont. 65	125 hr.		1800
Rocky Mount Flying Service, Municipal Airport, Rocky Mount, N. C.	Cruiser	Cont. 75	200 hr.	No	1800
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Cruiser J-5	Cont. 75	87 hr.	Never	1795
Lynn B. Fellison, 2811 Mulberry, St. Joseph, Mo.	J5	Cont. 75	83 hr.	New	1765
Wappingers Falls Airport, Wappingers Falls, N. Y.	Cruiser	Cont. 75	20 hr.	Never	1750
Northway Flying Service, Norton Field, Columbus, Ohio	Cruiser	Cont. 75	155 hr.	Like New	1750
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J4 '40	Cont. 65	93 hr.	None	1750
Southern Vt. Fly. Serv., Arpt., N. Springfield, Vt.	Cruiser	Cont. 75	40 hr.	New	1750
Inter City Aviation, East Boston Airport, Boston, Mass.	J 4 A	Cont. 65	175 hr.		1700
Dubois Avia. Assoc., Mun. Arpt., DuBois, Pa.	J4 '40	Cont. 65	97 hr.		1700
McVey Flying Service, Monmouth, Illinois	J5A	Cont. 75	305 hr.		1700
Susquehanna Air Service, Williamsport Airport, Montainville, Pa.	Coupe	Lyc. 65	83 hr.	Never	1650
Rudy Pickrul, Traverse City Arpt., Traverse City, Michigan	Coupe '40	Cont. 65 Dual	62 hr.		1650
Philadelphia Skyport, Inc., Pier Three South, Philadelphia, Pa.	Seaplane	Cont. 65	774 hr.	90 hr.	1650
Herman L. Martin, Munic. Arpt., Walla Walla, Wash.	J4	Cont. 65	450 hr.	25 hr.	1600
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	J-4	Cont. 65	383 hr.	353 hr.	1575
Sedalia Flying Service, 103 N. Ohio, Sedalia, Mo.	J5	Cont. 75	600 hr.	5 hr.	1500
Barr Aviation Corp., Detroit City Arpt., Detroit, Michigan	J4 Coupe	Cont. 65	175 hr.	None	1550
Southern Air Serv., Memphis, Tenn.		Cont. 65	100 hr.	New	1550
Philadelphia Skyport, Inc., Pier 3 South, Philadelphia, Pa.	Seaplane	Cont. 65	474 hr.	221 hr.	1525
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4 '40	Cont. 65	200 hr.	200 hr.	1500
Al Gillis Fly. Serv., 125 1st Ave., No., Great Falls, Mont.	Coupe '40	Cont. 65	350 hr.	None	1500
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-5	Cont. 75	100 hr.	New	1500

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	Over-HAULED	PRICE
Racine Fly. Serv., Racine Arpt., Racine, Wis.	J-4	Lyc. 65	330 hr.	top 320	$1475
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia	J3	Frnkln. 65	70 hr.	Never	1450
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J3	Cont. 65	98 hr	None	1440
Al Gillis Flying Service, P. O. Box 1806, Great Falls, Mont	Coupe '40	Cont. 65	700 hr.	Just	1400
Lynchburg Air Trans. and Sales Corp., Preston Glenn Airport, Lynchburg, Va	Coupe '39	Cont. 65	275 hr.	Never	1400
Lexington Fly. Serv., Munic. Arpt., Lexington, Kentucky	J5	Cont. 75	230 hr.		1400
Reliable Fly.Serv.,P.O.Box 1303,Bristol, Conn.	J-4	Cont. 65	140 hr.	30 hr. fact.maj.	1400
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J3	Frnkln. 65	142 hr.	None	1375
W. R. Franke, Shadwell, Va	J4	Cont. 65	402 hr.	100 hr.	1350
Philadelphia Skyport, Inc., Pier 3 South, Philadelphia, Pa	Seaplane	Cont. 65	976 hr.	740 hr.	1350
Virginia Cub Distributors, Box 211, Farmville, Va	J3	Lyc. 65	145 hr.		1350
Southern Vt. Fly. Serv., Arpt., Springfield, Vt.	J3L '40	Lyc. 65	162 hr.	New	1350
Dethloff Flying Service, Euclid Avenue Airport, Willoughby, Ohio	J3	Frnkln. 65	100 hr.	None	1325
Philadelphia Skyport, Inc., Pier Three South, Philadelphia, Pa	J-3	Cont. 65 Dual	247 hr.		1325
W. R. Franke, Shadwell, Va	J3	Lyc. 65	154 hr.	Never	1300
McBoyle Cub Sales, Airport,Lake Delton,Wisc.	Trainer	Frnkln. 65	189 hr.	Never	1300
John P. Hall, West Haven Airport, West Haven, Conn	J-3L	Lyc. 65	250 hr.	Never	1300
TriCities Avia. Sch., TriCities Arpt., Endicott, N. Y	J4 '39	Cont. 65	500 hr.		1300
Inter City Aviation, Inc., East Boston Airport, East Boston, Mass	Tandem	Cont. 65	550 hr.		1275
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas	J-3 Trainer	Frnkln. 65	169 hr.	No	1275
Southern Arwys. of Danville, Box 205, Danville, Va	J-3	Cont. 65	385 hr.	Never	1275
Southern Vt. Fly. Serv.,Arpt.,N. Springfield,Vt.	J3L '40	Lyc. 65	280 hr.	New	1250
John P. Hall, West Haven Airport, West Haven, Conn	J-3L	Lyc. 65	400 hr.	Never	1250
Madison Fly. Serv., R. I., Madison, Ind	J3L	Lyc. 65	205 hr.	No	1235
Al Gillis Flying Service, P.O. Box 1806, Great Falls, Mont	'40 J3F 65	Frnkln. 65	750 hr.	Just	1200
Mangen F. Warrington, Cub Fly. Serv., Selbyville, Del	J3 '39	Cont. 55 Dual	40 hr.	No	1200
John Ruzicks, Airport, Peru, Ind	J3	Frnkln. 65	140 hr.	No	1225
W. R. Franke, Shadwell, Va	J3	Frnkln. 65	280 hr.	Never	1200
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass	J-4	Cont. 65	550 hr.	400 hr.	1200
Galbraith Air Serv.,Munic. Arpt.,Paducah, Ky.	J3L	Lyc. 65	102 hr.	No	1195
Seidner Flying Service, S.A.M. Airport, Brookwood Dr., Youngstown, Ohio	Coupe '40	Cont. 65	349 hr.	113 hr.	1195
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia	J3 Trainer	Frnkln. 65	250 hr.	Never	1150
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia	J3 Trainer	Frnkln. 65	225 hr.	None	1150
Ferris Thomas, Municipal Airport, Knoxville, Tenn	J3F	Frnkln. 65	300 hr.	Never	1100
Virginia Cub Distributors, Box 211, Farmville, Va	J3	Lyc. 65	515 hr.	Yes	1100
Aviation Serv., Inc., Box 408, Newport News, Va	J3L	Lyc. 65	528 hr.	None	1100
Madison Fly. Serv., R. No. 1, Madison, Ind.	Coupe	Cont. 65	335 hr.	No	1100
Piedmont Aviation, Inc., Municipal Arpt., Winston-Salem, N. C	Coupe	Cont. 65 dual	432 hr.	112 hr.	1085
South Arwys. of Danville, Box 205, Danville, Va	J-3	Lyc. 55	570 hr.	Never	1075
Des Moines Flying Serv., Municipal Arpt., Des Moines, Ia	J3	Frnkln. 65	500 hr.	None	$1050
Gerald Gallagher, 4507 Marvive Ave., Drexel Hill, Pa	J-3	Cont. 65	720 hr.	95 hr.	1050
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas	J-3	Cont. 65	596 hr.	Yes	1050
Towners Fly. Serv., Towanda Arpt., Towanda, Pennsylvania	J-3-40	Lyc. 65	388 hr.	None	1050
Inter-City Fly. Serv., Mun. Arpt., Ft. Wayne, Ind	J3 '40	Frnkln. 65	456 hr.		1050
Northern Air Service, Grand Rapids Airport, Grand Rapids, Mich	J3L65	Lyc. 65	650 hr.		1025
Northway Flying Service, Norton Field, Columbus, Ohio	J3	Frnkln. 65	700 hr	200 hr.	1000
Northway Flying Service, Norton Field, Columbus, Ohio	J3	Frnkln. 65	650 hr.	175 hr.	1000
Northway Flying Service, Norton Field, Columbus, Ohio	J3	Frnkln. 65	800 hr.	200 hr.	1000
Cedar Rapids Airways, Inc., Cedar Rapids, Ia.	J	Lyc. 65	650 hr.	100 hr.	1000
Palo Alto Arpt., Inc., Box 640, Palo Alto, Cal		Cont. 65	1203 hr.	250 hr.	1000
Northway Flying Service, Norton Field, Columbus, Ohio	J3	Frnkln. 65	650 hr.	125 hr.	1000
Zimmerly Brothers Air Transport, Box 266, Lewiston, Idaho		Cont. 50	1300 hr.	90 hr.	1000
Spann Fly. Serv., Mun. Arpt. Colorado Springs, Colo	J4	Cont. 65	650 hr.	200 hr.	1000
Richmond Air Trans.,Byrd Arpt.,Richmond,Va.	J3	Frnkln. 60	530 hr.	215 hr.	1000
Midwest Avia. Corp.,Norton Fld.,Columbus, O.	Coupe	Frnkln. 60	600 hr.		1000
Stillwater Fly. Serv.,Box 466, Stillwater, Okla.	J3C	Cont. A50-5	1073 hr.	N'w eng.	1000
L. L. Rupert, Box 446, Muskogee, Okla	J3F '40	Frnkln. 50	150 hr.	like new	1000
Carpenter Air Service, 217 S. Popular, Wichita, Kansas	J-3	Lyc. 65	1190 hr.	Just	995
Pete Graim, R.F.D. 4, Staunton, Va	J3 '40	Frnkln. 60	650 hr.	10 hr.	995
Midwest Flyers, Lakeside Arpt., E. St. Louis, Ill.	J3F	Frnkln. 60	350 hr.	None	995
Mid-Western Avia. Co., 406 Kirkpatrick Bldg., St. Joseph, Mo	J-3	Frnkln. 50	1230 hr.	Just	985
Midwest Flyers, Lakeside Arpt., E. St. Louis, Ill.	J3L65 '40	Lyc. 65	875 hr.	Just	975
Ben C. Arquitt Mun. Arpt., Lima, Ohio	J3	Frnkln. 60	314 hr.	272 hr.	970
Consolidated Air Serv., Rubinkam Arpt., Harvey, Illinois	J3	Frnkln. 60	570 hr.	None	950
Herman L. Martin, Mun. Arpt. Walla Walla, Wash	J3	Frnkln. 50	1100 hr.	50 hr.	950
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.	J-3	Frnkln. 50	850 hr.	mjr. 750 hrs.	950
G. L. Williams, Syracuse Arpt., Syracuse, N. Y.	J3	Frnkln. 60	998 hr.	Recent	925
Rocky Mount Flying Service, Municipal Airport, Rocky Mount, N. C	J-3	Frnkln. 55	550 hr	25 hr.	900
Jersey Flying Service, Inc. Franklin Rd., Oakland, N. J	J-3	Frnkln. 60	550 hr.	500 hr.	900
L-H Air Service, Inc., Hatboro Airport, Hatboro, Pa	J-3	Lyc. 55	1050 hr.	50 hr.	900
Russ Walling, Walling-Watertown Arpt., Watertown, N. Y	J3	Frnkln. 50	925 hr.	500 hr.	900
Avia. Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 55	550 hr.	None	900
Consolidated Air Serv., Rubinkam Arpt., Harvey, Illinois	J3	Frnkln. 60	720 hr.	None	900
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass	J-3	Lyc. 55	900 hr.	700 hr.	900
Southern Air Serv., Memphis, Tenn		Lyc. 50	300 hr.	New	900
Bennett Air Serv.,P.O.Box247,Hightstown,N.J.	J3	Frnkln. 50	261 hr.	Just	895
Madison Flying Serv., R. 1, Madison, Ind	J3	Frnkln. 60	350 hr.		875
White Fly. Serv., Inc. Caldwell Wright Arpt., Caldwell, N. J	J3	Lyc. 50	1201 hr.	1 41	875
Lexington Fly. Serv., Inc., Lexington Arpt., Lexington, Ky	J-3	Lyc. 55	1050 hr.	1000 hr.	875
Southern Arwys. Sales Co., Munic. Arpt., Birmingham, Alabama	J-3	Frnkln. 50	450 hr.	425 hr.	875
Aircraft Associates, Inc., Mun. Arpt., Long Beach, Calif	J-3F-50	Frnkln. 50	830 hr.	80 hr.	850

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FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Al Guthrie, Box 466, Stillwater, Okla.	Trainer	Cont. 50	1300 hr.		$850
Rudy Pekrul, Traverse City Arpt., Traverse City, Mich.	J-3-F	Frnkln. 50	1190 hr.		850
West Coast Arcft. L.A. Munic. Arpt., Inglewood, Calif.	J3	Frnkln. 50	590 hr.	460 hr.	850
Krantz Aeron. Serv., Port Erie Arpt., Erie, Pa	J3	Frnkln. 50	950 hr.	No time since maj.	850
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J.	J 3	Lyc. 50	1275 hr.	8/40	850
Alabama Air Serv.,Auburn Arpt.,Auburn, Ala.	J3L	Lyc. 55	900 hr.	9/40	850
Midwest Avia. Corp., Norton Fld., Col., O.	J3F	Frnkln. 50	1080 hr.	2/41	850
Dethloff Fly. Serv., Euclid Ave. Arpt., Willoughby, Ohio	J-3	Frnkln. 50	800 hr.	Just maj.	850
Thomas Metcalf, Toledo Mun. Arpt.,Toledo, O.	J-3	Frnkln. 60	810 hr.	620 hr.	825
Inter City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	J-3 '40	Frnkln. 50	400 hr.	Never	800
James S. Campbell, Rolla, Mo.	Trainer	Frnkln. 50	600 hr.	Just	800
Rannells Air Service, Inc., Airport, Cumberland, Maryland	J3	Frnkln. 60	800 hr.	100 hr.	800
Page Airways, Arpt., Rochester, N. Y.	J3	Lyc. 50	1215 hr.	1086 hr.	800
Avia. Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 50	825 hr.	650 hr.	800
Warner Kenyon, 1326 29th St., Ashland, Ky.	J-3	Frnkln. 50	650 hr.	40 hr.	795
Johnson Flying Serv., Inc., Missoula, Mont.	J-3	Cont. 50	1400 hr.	200 hr.	795
Fayette Arwys., Inc., Uniontown, Pa.	J-3	Lyc. 50	900 hr.	12/40	785
Smith Fly. Serv., Wilkes-Barre Wyoming Valley Arpt., Forty-Fort, Pa.	J-3	Cont. 50	1230 hr.	870 hr.	775
Alabama Air Serv., Auburn Arpt., Auburn, Ala.	J-3	Frnkln. 50	725 hr.	550 hr.	775
Jones Fly. Serv., Sullivant Ave. Arpt., Columbus, Ohio	J-3	Frnkln. 50	1500 hr.	No time since fac.	775
Safair, Inc., Roosevelt Field, Mineola, N. Y.	J3	Cont. 65	1633 hr.	569 hr.	750
Southern Airways, Municipal Arpt., Birmingham, Ala.	J-3	Lyc. 55	1200 hr.	None	750
Regan Flying Service, Shawnee, Okla.	J3	Cont. 50	770 hr.	150 hr.	750
St. Louis Flying Service, Lambert Field, Robertson, Mo.	J3F-50	Frnkln. 4AC	1060 hr.	545 hr.	750
Southern Arwys., Munic. Arpt., Birmingham, Ala.	J-3	Lyc. 55	1000 hr.	1000 hr.	750
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa.	J-3	Lyc. 50	1100 hr.	Maj.	745
Jenkins Air Serv., Mun. Arpt., Rochester, N. Y.	J3 Trainer	Lyc. 50	1080 hr.	890 hr.	725
Southern Airways, Municipal Airport, Birmingham, Ala.	J-3	Frnkln. 60	800 hr.	None	700
Hawthorne Flying Service, Municipal Airport, Charleston, S. C.	J3	Frnkln. 50	1200 hr.		700
Safair, Inc., Roosevelt Field, Mineola, N. Y.	J3	Frnkln. 50	569 hr.	Just	700
Avia. Sales, Box 408, Newport News, Va.	J3L	Lyc. 50	1100 hr.	675 hr.	700
Midwest Avia. Corp., Norton Fld., Col., O.	J3F	Frnkln. 50	1068 hr.	2/41	700
Wallace Aircraft Co., Clarcona, Fla.	J2	Cont. 40	700 hr.	May '41	695
Johnny Haralson, Air Trans. & Sales Co., Toney Field, Pine Bluff, Ark.	J-3	Cont. A-44	650 hr.	600 hr.	695
Avia. Market, Los Angeles Metro. Arpt., Van Nuys, Calif.	J-2	Cont. 40	810 hr.	Yes	675
Oakland Arcft., Alameda, Calif.	J-2	Cont. 40	1785 hr.	May '40	665
Southern Airways, Municipal Airport, Birmingham, Ala.	J-3	Frnkln. 50	1000 hr.	None	650
F. W. Schrom, Box 164, Schrom Airport, Berwyn, Maryland	J-2	Cont. A-40-5	240 hr.	Never	650
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas	J-2 '36 Trainer	Cont. 40	647 hr.	Yes	650
Krantz Aeron. Serv., Port Erie Arpt., Erie, Pa.	J3	Cont. 40	750 hr.	30 hr. since	650
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	J3C	Cont. 40	589 hr.	25 hr.	595
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio	J-2	Cont. 40	396 hr.	90 hr.	579
Piedmont Avia., Munic. Arpt., Winston-Salem, N. C.	J-3	Cont. 40	516 hr.	201 hr.	575
McBoyle Cub Sales, Airport, Lake Delton, Wisconsin	J2	Cont. A40	850 hr.	150 hr.	550
Rannells Air Service, Inc., Airport, Cumberland, Maryland	J-2	Cont. 40	500 hr.	50 hr.	500
Lexington Fly. Serv.,Mun. Arpt.,Lexington, Ky.	J-2	Cont. A-40-5	825 hr.		550
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	J-2	Cont. 40	650 hr.	500 hr.	550
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	J-2	Cont. 40	250 hr.		550
Piedmont Avia., Inc., Munic. Arpt., Winston-Salem, N. C.	J-2	Cont. 40	574 hr.	100 hr.	525
PITCAIRN					
Boulevard Airport, Inc., Roosevelt Road, Philadelphia, Pa.	Mailwing	Wright J6-7	350 hr.	Never	1800
PORTERFIELD					
Otha Eddleman, P.O. Box 116, Crane, Tex.	CP-65	Cont. 65	43 hr.	New	1437
Orangeburg Flying Service, Inc., Box 250, Orangeburg, S. C.	Turner	Cont. A50-L	100 hr.	Never	1250
Midwest Flyers, Lakeside Arpt., E. St. Louis, Ill.	LP65 '40	Lyc. 65	700 hr.	Never	1050
Schneider Aero Service, Chandler Field, Fresno, California	CP-65	Cont. 65	1300 hr.	25 hr.	975
Aircraft Associates, Inc., Municipal Airport, Long Beach, Calif.	LP65	Lyc. 65	1416 hr.	Just	850
St. Louis Flying Service, Lambert Field, Robertson, Mo.	35-70	LeBlond 70	406 hr.	4 hr.	750
Orangeburg Flying Service, Inc., Box 250, Orangeburg, S. C.	35-70	LeBlond	375 hr.	40 hr.	600

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
REARWIN					
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	Cloudster	Ken-Royce 120	New	Never Topped	$4995
C. W. Peterson, Mun. Arpt., Salina, Kansas	Cloudster	Ken-Royce 120 h.p.	300 hr.	270 hr.	3200
Al Gillis Flying Service, P. O. Box 1806, Great Falls, Mont.	Cloudster	Ken-Royce 120	225 hr.	Just	2950
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	Skyranger	Frnkln. 80	19 hr.	Never	2695
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	Skyranger	Cont. 75	New	Never	2575
Aero Sales Corp., First National Building, Birmingham, Ala.	Skyranger	Frnkln. 80	New		2545
C. Evers, 247 Park Av., N. Y. C.		Warner 90	138 hr.	None	2250
Aero Sales Corp., 1008 First National Building, Birmingham, Ala.	Skyranger	Frnkln. 80	27 hr.		2200
Paris Fly. Serv., Mun. Arpt., Paris, Texas	Skyranger	175 Cont. 75	125 hr.		2100
M. H. Wall, P.O. Box 327, Willoughby, O.	Skyranger	175 Cont. 75	35 hr.		1935
Dewey Eldred Fly. Serv., Inc., Willoughby, O.	Skyranger	Cont. 75	40 hr.		1845
Jennings Bros., No. Grafton, Mass.		LeBlond 70	680 hr.	50 hr.	1075
E. W. Wiggins Airways, Inc., Boston, Met. Arpt., Norwood, Mass.	8500	LeBlond 85	802 hr.	111 hr.	975
Southern Arwys. of Danville, Box 205, Danville, Va.	1936	LeBlond 85	368 hr.	Never	975
Racine Fly. Serv., Racine Arpt., Racine, Wis.	7000	LeBlond 70	536 hr.	510 hr.	850
RYAN					
Standard Fly. Serv., Inc., Somerset Hills Arpt., Basking Ridge, N. J.	STA	Menasco 125	190 hr.	150 hr.	3450
Schneider Aero. Serv., Chandler Fld., Fresno, Calif.	Photographic	Wright J-6-9 B-5 10-15-1			
W. R. Franke, Shadwell, Va.	STA	Blower Menasco 125	1625 hr. 700 hr.	120 hr. 100 hr.	1350 3300
SIKORSKY					
Aviation Market, L.A. Met. Arpt., Van Nuys, Calif.	S-39	Wasp 450	540 hr.	40 hr.	6850
E. W. Wiggins Airways, Inc., Boston Municipal Airport, E. Boston, Mass.	S-39	P&W 400	1349 hr.	239 hr.	4500
G & G Airlines Co., Ltd., P.O. Box 4187, University Sta., Tucson, Ariz.	S-39-CS	Wasp Jr. 375	663 hr.	150 hr.	4500
SPARTAN					
Spartan Sch. of Aero., Box 2551, Tulsa, Okla.	C-3	Wright J6-7 225 h.p.	900 hr.	Just	700
STANDARD					
Becker Arcft. Sales, Bettis Arpt., Homestead, Pa.	D-25	J-5-225	500 hr.	150 hr.	1500
A. A. Knowles, Rt. 4, Boise, Ida.	New	Wright J 5 220	417 hr.	3/40	1000
Bob Wight, Box 487, Biloxi, Miss.	D-25	J-5-220	Motor 1275 hr.	Motor 670 hr.	850
STEARMAN					
St. Louis Flying Service, Lambert Field, Robertson, Mo.	C3R	Wright J6-760	1493 hr.	88 hr.	1750
Stinson Fly. Corp., San Francisco Mun. Arpt., S. San Francisco, Calif.	Hammond	Menasco 150	500 hr.	10/40	1500
Mamer-Shreck Air Transport, Felts Field, Spokane, Washington		Wright J-5	847 hr.	107 hr.	1250
Tacoma Fly. Service, Box 157, So. Tacoma, Wash.	C-3-B	Wright J-5 220	1800 hr.	Recently	800
STINSON					
F. W. Schrom, Schrom Airport, Berwyn, Md.	SR8D	Wright 350	330 hr.	115 hr.	9000
F. W. Schrom, Schrom Airport, Berwyn, Md.		Wright 350 Reliant SR-SD	240 hr.	Just	9000
Hyannis Arpt. Corp., Box 592, Hyannis, Mass.	Reliant	Lyc. 245	388 hr.	2/41	6000
Thomas Oakes, 240 Belleville Ave., Bloomfield, N. J.	SR9BD	Lyc. 245	620 hr.	350 hr.	4500
Brinckerhoff Flying Serv., Inc., College Park Airport, College Park, Md.	SR5A	Lyc. 245	630 hr.	25 hr.	4250
Pete Grim, R.F.D. 4, Staunton, Va.	Voyager	Frnkln. 90	135 hr.	Never	3500
Indiana Air Serv., Inc., Bendix Fld., So. Bend, Indiana	SR-7C	Lyc. 260	1600 hr.	3/41	3500
Oak Air Serv., Inc., Bates Fld., Mobile, Ala.	Spec. 105	Cont. 80	200 hr.		3250
Air Serv., Inc., Bellanca Fld., New Castle, Del.	105	Cont. 80	101 hr.	2 hr.	2950
Leech Aircraft, Inc., Hangar F., Roosevelt Field, Mineola, L. I., N. Y.	"105"	Cont. 80	110 hr.	Never	2900
Cincinnati Arcft. Serv., Lunken Arpt., Cincinnati, Ohio	105	Cont. 80	201 hr.	Never	2850
Leech Aircraft, Inc., Hangar F., Roosevelt Field, Mineola, L. I., N. Y.	"105"	Cont. 80	326 hr.	Never	2600
Paul E. DePover, Marshall, Minn.	105	Cont. 80	80 hr.		2600
Jenkins Air Serv., Inc., Mun. Arpt., Rochester, N. Y.	105	Cont. 80	215 hr.		2550
Detroit School of Aviation, Joy Airport, Fraser, Michigan	105	Cont. 80	145 hr.		2500
Mamer-Shreck Air Transport, Felts Field, Spokane, Washington	105	Cont. 75	236 hr.	236 hr.	2500
Pete Grim, R.F.D. 4, Staunton, Va.	105	Cont. 80	211 hr.	None	2500

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
Moline Fly. Serv. Mun. Arpt., Moline Illinois	SR-5A Lyc. 245	850 hr.	760 hr.	$2495
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md	105 Cont. 180	200 hr.	Eng.50hr. New	2450
Stinson Flying Company, Alameda Airport, Alameda, California	105 Cont. 80	350 hr.	Aug. '40	2450
G & G Airlines Co., Ltd., P.O. Box 4187, University Sta., Tucson, Ariz	105 Cont. 80	398 hr.	170 hr.	2250
Joseph Harrell, P.O. Box 202, Eugene, Ore.	105 Cont. A-80	469 hr.	130 hr.	2200
Hood Aircraft Sales Co., P.O. Box No. 164, Turners Falls, Mass	SR5E Lyc. 225	500 hr.	50 hr.	2195
Colo. Avia. Co., 426 U.S. Nat'l B.B., Denver, Colo	105 Cont. 175	400 hr.	Yes	2150
Upton & Bowen, West Memphis, Ark	105 Cont. 75	275 hr.	5 hr.	2000
D. A. Furlong, Box 181, Clarion, Pa	105 Cont. 75	400 hr.		1950
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I	SR 5 Lyc. 225	1350 hr.	10 hr.	1900
Colorado Aviation Company, 426 U.S. Nat'l Bank Building, Denver, Colo	105 Cont. 75	380 hr.	Recently	1900
Leech Aircraft, Inc., Hangar F, Roosevelt Field, Mineola, N. Y	105 '39 Cont. 75	640 hr.	60 hr.	1500
Becker Aircraft Sales, Bettis Arpt., Homestead, Pa	SR Lyc. 225	600 hr.	50 hr.	1350
Akron Airways, Arpt., Akron, Ohio	SR Lyc.	850 hr.	350 hr.	1350
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md	Stinson '33 Lyc. 215	900 hr.		1300
R. E. B. Springer, Box 567, Waynesburg, Pa.	SM-8A Lyc. 215	1200 hr.	50 hr.	1200
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Mich	R Lyc. 215	1000 hr.	90 hr.	1195
Foster A. Lane, Port Columbus, Columbus, Ohio	Lyc. 215	927 hr.	40 hr.	1100
Springfield Avia. Co., Munic. Arpt., Springfield, Illinois	SM-8A Lyc. 215	750 hr.	360 hr.	1050
Livingston Airways Corp., Chapman Fld., Waterloo, Iowa	SM-8A Lyc. 215	930 hr.	900 hr.	1000
DuBois Avia. Assoc., Munic. Arpt., DuBois, Pa.	S Lyc. 215	1053 hr.	347 hr.	950
Flying Dutchman Air. Serv., Sometown Arpt., Phila., Pa	SM-8A Lyc. 220	1474 hr.	30 hr.	875
Wappingers Falls Airport, Wappingers Falls, N. Y	SM8A Lyc. 215	750 hr.	150 hr.	850
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C	SM-8A Lyc. 215	850 hr.	820 hr.	800
Four Lakes Aviation Corp., Royal Airport, Madison, Wisc	S Wright 175	1200 hr.	150 hr.	775
Becker Arcft. Sales, Bettis Arpt., Homestead, Pa	SM-8A Lyc. 215	700 hr.		700
Leeward Avia., New Kensington, Pa	SM-2 Warner 125	550 hr.	Yes	500
TAYLORCRAFT				
G. A. Short, Walnut, Illinois	DeLuxe BC12 Cont. 65	45 hr.	Never	2050
Moberly Flying Service, 605 Cancannon St., Moberly, Mo	B-12 '41 Del. Lyc. 65	30 hr.	New	1975
Inter-City Flying Service, Municipal Airport, Ft. Wayne, Ind	1941 Deluxe Cont. 65	100 hr.	Never	1850
Avia. Mkt., L.A. Metro. Arpt., Van Nuys, Calif	BL-65 Lyc. 65	38 hr.	New	1875
Niederhauser Airways, 104 South 5th St., Marshalltown, Ia	B-12 Cont. 65	192 hr.	New	1850
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind	'41 Deluxe Cont. 65	150 hr.	Never	1850
Lynchburg Air Transport & Sales Corp., Preston Glenn Airport, Lynchburg, Va	BC 12 Cont. 65	175 hr.	Never	1850
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash	BL Del. Lyc. 65 dual	200 hr.		1825
Inter-City Flying Service, Municipal Airport, Ft. Wayne, Ind	1941 Deluxe Cont. 65	290 hr.	Never	1800
West Coast Arcft., L. A. Munic. Arpt, Inglewood, Calif	Silvercraft Lyc. 65	53 hr.	New	1795
Wichita Falls Air Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Tex	BL-65 Lyc. 65	New	New	1750
Springfield Avia. Co., Munic. Arpt., Springfield, Ill	BC-65 Cont. 65	195 hr.	None	1750
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind	'41 Deluxe Cont. 65	400 hr.	Never	1725
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind	'41 Lyc. 65	140 hr.	Never	1695
Washington Pk. Arpt., Homewood, Ill	Cont. 65	150 hr.	None	1650
Tuscarawas County Aviation, Inc., Municipal Airport, New Philadelphia, Ohio	BL12 Lyc. 65	215 hr.	Never	1645
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J	BL Lyc. 65 h.p.	138 hr.	Never	1625
Moline Fly. Serv., Munic. Arpt., Moline, Ill	Deluxe BC Cont. 65	950 hr.	Maj.now	1600
Tuscarawas County Aviation, Inc., Municipal Airport, New Philadelphia, Ohio	BL-12 Lyc. 65	248 hr.	Never	1595
West Coast Arcft., L. A. Munic. Arpt., Inglewood, Calif	BC-65 Cont. 65	465 hr.	No	1595
Les C. Myers, Rapid City, S. D	BC '40 Cont. 65	165 hr.	Never	1550
Hubert & Dillon Air Serv., Box 177S, Tacoma, Wash	BC Cont. 65	450 hr.	Motor topped	1525
Roch. Aeron. Corp., Roch. Arpt., Roch., N. Y.	BL-65 Lyc. 65	80 hr.		1525
Walter D. Mauk, Blackwell, Okla	Lyc. 65	400 hr.	None	1500
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I	BL-40 Lyc. 65	254 hr.	Will be	1495
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn	BL-65 Lyc. 65	68 hr.	New	1475
Ranger Fly. Serv., Ranger, Texas	BL-65 Lyc. 65	140 hr.	140 hr.	$1450
Rochester Aeronautical Corp., Rochester Arpt., Rochester, N. Y	BL-65 Lyc. 65	470 hr.		1450
Hood Aircraft Sales Co., P.O. Box 164, Turners Falls, Mass	BL-65 Lyc. 65	490 hr.	Never	1445
Inter-City Fly. Serv., Munic. Arpt., Ft. Wayne, Ind	BC DeLuxe Cont. 65	800 hr.	757 hr.	1445
Moline Fly. Serv., Munic. Arpt., Moline, Ill	DeLuxe BL Lyc. 65	675 hr.	None	1400
Palmyra Arpt., 817 Lincoln Ave. Palmyra, N. J.	BL Lyc. 65	318 hr.	Never	1400
Ranger Fly. Serv., Munic. Arpt., Ranger, Texas	BL-65 Lyc. 55 dual	170 hr.	170 hr.	1395
Washington Park Arpt., Inc., Homewood, Ill.	Lyc. 50	85 hr.	None	1390
Niederhauser Airways, 104 So. 5th, Marshalltown, Ia	B Lyc. 65	725 hr.	150 hr.	1375
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y	Lyc. 65	585 hr.	No	1350
Peoria Aero Sales Co., 342 Knoxville, Peoria, Illinois	BC-65 Lyc. 65	120 hr.		1350
Dawson Air Serv., Box 852, Salina, Kans.	DeLuxe BL Lyc. 65	840 hr.	Just	1350
Ranger Fly. Serv., Ranger, Texas	BL-55 Lyc. 55	180 hr.	180 hr.	1350
Tuscarawas County Aviation, Inc., Munic. Arpt., New Philadelphia, Ohio	BL Lyc. 65	987 hr.	Never	1345
Inter-City Flv., Munic. Arpt., Ft Wayne, Ind.	BL '40 Lyc. 50	326 hr.		1325
Franklin Aviation, Inc., Toledo, Ohio	'40 Cont. 65	850 hr.	Just	1300
Greenville Sch. Avia., Treaty City Arpt., Greenville, Ohio	BL Lyc. 65	265 hr.	None	1300
Hopewell Fly. Serv., Hopewell Arpt., Hopewell, Va	BL-65 Lyc. 65	375 hr.	9/40	1300
Tuscarawas County Aviation, Inc., Munic. Arpt., New Philadelphia, Ohio	BL Lyc. 65	1115 hr.	471 hr.	1275
Inter-City Flying Service, Municipal Airport, Fort Wayne, Ind	Deluxe '40 Cont. 65	1200 hr.	250 hr.	1275
Peoria Aero Sales Co., 342 Knoxville, Peoria, Illinois	BC-65 Lyc. 65	180 hr.		1250
Piedmont Aviation, Inc., Municipal Airport, Winston-Salem, N. C	Trainer '40 Lyc. 65 Dual	77 hr.	None	1200
Earl J. Howard, P.O. Box 565, Ames, Iowa	BLT Lyc. 65	510 hr.	None	1200
Marlboro Arpt., Inc., Farm Road, Marlboro, Mass	BL-65 Lyc. 65	372 hr.	None	1200
Rochester Aeron. Corp., Rochester Arpt., Rochester, N. Y	BL-55 Lyc. 55	500 hr.	None	1200
Tuscarawas County Aviation, Inc., Municipal Airport, New Philadelphia, Ohio	BL Lyc. 65	880 hr.	Never	1195
Boyd Mote, Denman Ave., Coshocton, Ohio	BL-50 Lyc. 50	105 hr.	New 1940	1195
Dufort Sch. Aero., 57 Ft. Covington St., Malone, N. Y	BT Lyc. 55 h.p.	395 hr.	New 5/40	1175
Roscoe Turner Aeron. Corp., Indianapolis, Ind.	'40 DeLuxe Cont. 65	556 hr.	56 hr.	1125
G & G Airlines Co., Ltd., P.O. Box 4187 University St., Tucson, Ariz	BC-50 Cont. 50	1300 hr.	100 hr.	1100
Roscoe Turner Aeron. Corp., Indianapolis, Ind.	'40 Deluxe Cont. 65	590 hr.	None	1100
Harry C. Phillips, Phillips Flying Service, Mt. Pleasant, Mich	BLT Lyc. 50	500 hr.	Never	1100
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J	BLT Lyc. 50 h.p.	373 hr.	83 hr. Since Maj.	1100
Dewey Eldred Fly. Serv., Lost Nation Arpt., Willoughby, Ohio	BL-65 Lyc. 65	Ship 831 hr.	11/40	1100
Phillips Flying Service, Arpt., Mt. Pleasant, Mich	BL-50 Lyc. 50	800 hr.	650 hr.	1100
Four Lakes Aviation Corp., Royal Airport, Madison, Wisconsin	'39 Deluxe Lyc. 65	650 hr.	260 hr.	1075
Roscoe Turner Aeron. Corp., Indianapolis, Ind.	'40 Deluxe Cont. 65	580 hr.	None	1065
Duane L. Huscher, Box 65, Lawton, Okla	BF Frnkln. 50	1302 hr.	197 hr.	1050
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	BL Lyc. 50	570 hr.	No	1050
Ryan Air Serv., Decorah, Iowa	Late '39 Lyc. 50	770 hr.	350 hr.	1050
Wichita Falls Air Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Texas	BLT-55 Lyc. 55	400 hr.	Since 50 hr.	1050
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	BL-50 Lyc. 50	1100 hr.	900 hr.	1050
Merrill Hale, Hillsgrove, R. I	Frnkln. 50	268 hr.	35 hr.	1050
Foster A. Lane, Port Columbus, Columbus, O.	Lyc. 65	773 hr.	225 hr.	1000
Indiana Air Serv., Bendix Fld., South Bend, Ind	BL Lyc. 55	1038 hr.		1000
Louis A. Musgrove, Box 814, Morgantown, W. Va	BL Lyc. 50	725 hr.	150 hr.	1000
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I	BF Frnkln. 50	351 hr.	130 hr. Since	9.95
Walter D. Mauk, Municipal Airport, Blackwell, Okla	Cont. 50	782 hr.	125 hr.	950
Schneider Aero. Serv., Chandler Fld., Fresno, Calif	BC Cont. 50	1216 hr.	106 hr.	9.50
Harry C. Phillips, Phillips Flying Service, Mt. Pleasant, Mich	BL-T Lyc. 50	1100 hr.	400 hr.	925
Indiana Air Serv., Bendix Fld., South Bend, Ind	BL Lyc. 50	970 hr.		900
Foster A. Lane, Lane Avia. Corp., Cleveland Arpt., Cleveland, Ohio	Lyc. 50	950 hr.	50 hr.	875
Moberly Fly. Serv., 605 Concannon St., Moberly, Mo	'39 Frnkln. 50	720 hr.	Topped 60 hr.	875
Four Lakes Aviation Corp., Royal Airport, Madison, Wisconsin	B Lyc. 50	1200 hr.	450 hr.	850
Harry C. Phillips, Phillips Flying Service, Mt. Pleasant, Mich	BL-T Lyc. 50	1500 hr.	500 hr.	850

(Continued on page 113)

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CUB Cruiser J5 Continental 75 Licensed. 24 gal. tank, instruments, brakes, starter, special paint job. Purchased in May. Total hours 140. $1795. Francis Kane, Wellsville, N. Y.

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(*Continued from page* 111)

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DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
Piedmont Avia., Munic. Arpt., Winston-Salem, N. C.	'39 Frnkln. 50	563 hr.	164 hr.	$825
Foster A. Lane, Port Columbus, Columbus, O.	BL Lyc. 50	1700 hr.	497 hr.	800
Leon D. Sherrick, McKinley Airport, Canton, O.	'39 DeLuxe Lyc. 50	1175 hr.	300 hr.	795
Dufort School of Aeronautics, Massena Airport, Massena, N. Y.	BF Frnkln. 50	785 hr.	Just	795
Canton Avia. Co., Martin Fld., Canton, O.	BL-T Lyc. 50	780 hr.	Engine Maj.	795
Walter D. Mauk, Municipal Airport, Blackwell, Okla.	Cont. 40	1400 hr.	New Engine	750
Kenneth Benesh, Monticello, Ia.	A Cont. 40	180 hr.	None	745
Lowell White, Fairview, Ill.	Cont. A40	500 hr.	400 hr.	725
Duane L. Huscher, Box 65, Lawton, Okla.	A Cont. A40-4	600 hr.	75 hr.	725
Rome Boekenhoff, Jr., 2038 Spring St., Quincy, Ill.	A Cont. 40	576 hr.	2/41 Since	700
Carnahan Fly. Serv., Bloomington, Ill.	Cont. 40	507 hr.	100 hr.	700
Niederhauser Airways, 104 South 5th St., Marshalltown, Ia.	A Cont. 40	710 hr.	280 hr.	695
Merrill Hale, Hillsgrove, R. I.	Cont. 40	1081 hr.	100 hr.	695
Virginia Cub Distributors, Box 211, Farmville, Va.	Cont. 40	500 hr.	Just	670
Lynchburg Air Transport and Sales Corp., Preston Glenn Airport, Lynchburg, Va.	'38 Cont. 40	375 hr.	Never	650
Springfield Avia. Co., Munic. Arpt., Sprgfld., Ill.	Cont. A-40-4	375 hr.	None	650
J. L. Wells, 106 W. Main, Avon Park, Fla.	Cont. 40	690 hr.	100 hr.	650
W. R. Franke, Shadwell, Va.	J3 Cont. 40	460 hr.	Just	600
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	A Cont. 40	550 hr.	520 hr.	600
TRAVELAIR				
Falcon Arcft. Corp., L. A. Munic. Arpt., Inglewood, Calif.	Osprey Wright 250	814 hr.	80 hr.	2500
Art Whitaker, Box 3820, Portland, Oregon.	Wright J6-7	1100 hr.	100 hr.	1850
Baltimore School of Aeronautics, Curtiss-Wright Airport, Smith and Greenspring Avenues, Baltimore, Md.	16K B5125			1400
Northeast Airways, Inc., Portland City Arpt., Portland, Maine	Trainer '40 Lyc. 55	591 hr.	91 hr.	1250
Indiana Air Serv., Inc., Bendix Fld., So. Bend, Ind.	4000 Wright J-5, 220	940 hr.	7/40	1200
Aviation Service Company, Inc., Box 32, Hartford, Conn.	BL Lyc. 55	324 hr.	No	1200
Clinch Flying Service, Municipal Airport, North Platte, Nebr.	BL Lyc. 50	931 hr.	908 hr.	1200
Louis A. Musgrove, Airport, Elkins, W. Va.	BL-T Lyc. 65	600 hr.	200 hr.	1200
H. E. Oliver, 63 Orchard St., Pittsfield, Mass.	BL Lyc. 55	450 hr.	Top 400 hr.	1200
Midwest Flyers, Lakeside Arpt., E. St. Louis, Ill.	4000 '27 220	1500 hr.	90 hr.	1125
Kenneth Benesh, Monticello, Ia.	4000 Wright J-5, 225	1200 hr.	30 hr.	1100
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	4000 Wright J65	12 hr.	Since	1050
C. W. Peterson, Munic. Arpt., Salina, Kans.	C-4000 Chall. 185	600 hr.	Topped 12 hr	1000
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	4000 Wright J5	975 hr.	15 hr.	895
Regan Flying Service, Shawnee, Okla.	E-4000 Wright J6-5	337 hr.	Just	800
Leeward Avia., New Kensington, Pa.	Chall. 185	700 hr.	Yes	745
Leeward Aviation, New Kensington, Pa.	4000 Chall. 185	600 hr.	48 hr.	$725
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	2000 Tank 115	855 hr.	150 hr.	675
WACO				
Livingston Airways Corp., Chapman Field, Waterloo, Iowa	S '37 Jacobs 225	185 hr.		4200
Thompson Flying Service, Salt Lake Airport, Salt Lake City, Utah	UPF-7 Cont. 220	1850 hr.	20 hr.	4000
Seidner Flying Service, S.A.M. Airport, Brookwood Dr., Youngstown, Ohio	'36 Jacobs 285	931 hr.	30 hr.	3450
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	Custom Cab '36 Wright 285	800 hr.	Eng. 50 hr.	3400
Air Serv., Inc., Munic. Arpt., Denver, Colo.	Cust. Cabin Jacobs 225	990 hr.	2/41	3400
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Safair, Inc., Roosevelt Field, Mineola, N. Y.	YMF Jacobs 225	1236 hr.	Just	2990
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E. W. Wiggins Arwys., Inc., Providence, R. I.	C Wright 285	350 hr.	Recently	2500
Avia. Serv. Co., Inc., P.O. Box 32, Hartford, Conn.	YOC Jacobs 225	720 hr.	220 hr.	2250
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Inter-City Avia., Inc., Boston Munic. Arpt., E. Boston, Mass.	Cabin Jacobs 225	845 hr.	213 hr.	2175
John P. Hall, West Haven Arpt., West Haven, Conn.	YMF Jacobs 225	710 hr.	60 hr.	2100
Rocky Mount Flying Service, Municipal Airport, Rocky Mount, N. C.	UEC Cont. 210	900 hr.	80 hr.	2000
J. L. Wells, 106 W. Main, Avon Park, Fla.	YKC Jacobs 225	650 hr.	200 hr.	2000
Southern Arwys. of Danville, Box 205, Danvill, Va.	YKC Jacobs 225	917 hr.	550 hr.	1850
Greenville Sch. of Avia., Treaty City Arpt., Greenville, Ohio	Cabin Cont. 210	850 hr.	2/41	1750
Harold W. Gruchy, 1326 Walnut St., Wenton Highlands, Mass.	UIC Cont. 210	790 hr.	46 hr.	1600
Capt. Arthur J. Davis, Box 446, East Lansing, Michigan	RNF Warner 125	500 hr.	100 hr.	1500
Hawthorne Flying Service, Municipal Airport, Charleston, S. C.	'32 Cabin Cont. 165	600 hr.	500 hr.	1295
Leeward Aviation, New Kensington, Pa.	JIC Cont. 210	850 hr.	70 hr.	1295
Lynchburg Air Trans. and Sales Corp., Preston Glenn Airport, Lynchburg, Va.	RNF Warner 125	1173 hr.	90 hr.	1250
Lynchburg Air Transport and Sales Corp., Preston Glenn Airport, Lynchburg, Va.	RNF Warner 125	1175 hr.	100 hr.	1250
Shaw Aircraft Co., Munic. Arpt., Iowa City, Ia.	RNF Warner 125	1000 hr.	83 hr.	1250
Henry B. Chapman, N. O. Arpt., New Orleans, La.	RNF Warner 125	720 hr.	6 hr.	1100
Red Bank Airport, Inc., Red Bank, N. J.	ENF Martin 120	575 hr.	35 hr.	1089
Southern Air Serv., Memphis, Tenn.	Warner 125	1000 hr.	Recently	1050
Arthur J. Davis, E. Lansing, Mich.	CTO Wright J6-9	1200 hr.		900
Howard G. Mayes, P.O. Box 2104, Huntington, W. Va.	F Warner 125	1680 hr.	292 hr.	750

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